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Seminole County, Florida Solid Waste Management Plan

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SEMINOLE COUNTY, FLORIDA
SOLID WASTE MANAGEMENT PLAN

BY

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RESEARCH REPORT

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ABSTRACT

The Seminole County, Florida solid waste transportation network was examined to determine alternate locations of transfer stations. The scope of this study is limited to transportation and assumed disposal costs. Collection costs are not included. Review of past generation records was conducted and a per capita generation rate of 4 lbs/day was determined. This compared favorably to 4.06 lbs/day for Orange and Brevard County.

The cost per ton for the present solid waste management system was computed and compared to alternative systems. The present system was compared to several alternatives by altering the number and changing the locations of transfer stations to arrive at an optimum cost configuration.

Recommended alternate plans are provided which are dependent upon the waste generating districts participating as well as transfer station location in the overall solid waste management system.

Director of Research Report
Martin P. Wanielista, Ph.D., P.E.

ACKNOWLEDGMENT

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My special thanks to my son Paul for his patience and understanding why many of the father-son projects had to be delayed.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

Objective

The objective of this report is to evaluate the present Seminole County Comprehensive Solid Waste Disposal System. This report will provide a basis for decision makers to assess the adequacy of current methods against alternate transfer site locations utilizing the existing Osceola sanitary landfill.

Scope

This study covers the dimensions of time, waste load and geographic area contributing to the solid waste stream.

Population projections are based upon Seminole County plan 3 using traffic zone estimates prepared by the East Central Florida Regional Planning Council.[1]

Per capita solid waste generation rates along with population projections are used to establish acreage required at the landfill. The time frame of this study spans a 14 year period from 1976 to 1990. The design year 1990 was selected as sufficient land area is available at the Osceola site to accommodate the contingencies examined.

This plan is developed to include all Seminole County and includes alternatives to either exclude the city of Sanford or to

include the cities of Eatonville, Maitland, and Winter Park from Orange County as deemed appropriate by the decision making entity.

Costs as reported within are those associated with transport of solid waste from the centroid of generating district to transfer stations, from transfer stations to the Osceola landfill, ORM and capital costs of the transfer stations and landfill. The local collection cost (curbside or rear) is not included. Hazardous wastes and white goods collection and disposal costs are not included.

Authority and Responsibility

The legal basis for the County and local governments to enter into a comprehensive solid waste management plan is well established in Florida statutes, Chapter 163, 1973 and the Seminole County Comprehensive Planning Act of 1974. This act requires that county, municipalities and other units of local government prepare and adopt comprehensive plans that

> ". . . facilitiate the adequate, economic, orderly, timed and efficient provision of transportation, water, sewage, fire protection, SOLID WASTE DISPOSAL, . . . within their jurisdiction." [2]

CHAPTER II

SUMMARY, RECOMMENDATIONS AND CONCLUSIONS

Summary

Seminole County, Florida faced with the problem of re-evaluating its solid waste disposal system must seek solutions toward operating an efficient collection, transfer, and disposal solid waste system that complies with State requirements, yet provides the most service for the dollar.

The major emphasis of this report has been to evaluate the current transfer station operation and the cost effectiveness of their locations in relation to other sites. These were considered utilizing several waste generation options both in areas served and in per capita generation rates. It is assumed that the present Osceola sanitary landfill will be used and that efforts will be expended to bring the facility up to State standards.

Factors not considered in the models include levels of service to collection areas, manner of collection, and public input considering acceptance of proposals.

Recommendations

The collection districts should be established in accordance with the proposed waste generation districts outlined in this report. Municipalities should be responsible for solid waste collection

within their corporate boundaries and encouraged to include those non boundary areas within each waste generation district depicted in this report (see Figure 4, page 15).

Private, exclusive franchises should be established by district for the unincorporated and incorporated areas that do not have public collection services. Collectors in each proposed waste generation district should be allowed the opportunity to agree upon a division of the district. Should agreement not be reached by private collectors, the responsible government should require competative bids for collection using micro-routing hueristic techniques[3] or other methods of collection deemed appropriate for the district.

Franchised collectors should be required to submit a daily route schedule for each collection day to the entity in control in order to prevent solid waste from one County or district being collected along with an adjacent County's or district's solid waste. Submission should be done prior to award of the franchised district. This would provide a measure of control and allow for more realistic solid waste monitoring and computation of solid waste generation rates for planning purposes.

Because of the close proximity of developed areas among municipalities of both Orange and Seminole County, firm guidelines should be established jointly by both County governments for disposing of solid waste at facilities within their own jurisdiction to preclude possible criticism of subsidizing disposal of solid wastes from outside the County and would provide more effective control over

the daily waste loads received at each transfer facility.

Conclusions

The present County system with transfer stations at Sanlando, Upsala, and Oviedo is the most cost effective compared to closing or relocating any of the existing transfer stations providing no changes are made in the present generating districts currently allowed to use the facilities. This includes the districts in Orange County and excludes the city of Sanford. This system's average present worth cost over 14 years is $3.36/ton. These costs do not include the local collection (curbside or rear) pick up.

Should Orange County decide to require that all waste from their County be disposed at an Orange County facility as recommended in a recent report by ACT Systems, Inc.[4] and should the city of Sanford remain outside the Seminole County system it would be advisable to close the Upsala transfer station and erect a new facility at the Seminole County Public Works Yard. This would decrease the demand placed upon the Sanlando transfer station and more evenly distribute solid waste loads from the Northern and Southwestern sectors of the County between the two facilities. This system average cost over 14 years is $3.35/ton.

If Sanford is to be included in the overall County solid waste management system at any date in the near future, the overall cost of the system in its present configuration (including Orange County) would be approximately the same. However, a small cost savings could be realized by closing the Upsala site and opening a new

transfer station at the Sanford Airport with an average cost over 14 years of $3.30/ton.

A single transfer station operation for Seminole County was investigated for comparison purposes with a transfer station located at either Sanlando, Seminole County Public Works Yard, or in Longwood off highway 17-92. The cost per ton for each single site operation was $3.60, $3.94, and $3.63 respectively with all three options exceeding the cost of having one transfer station located in close proximity to each of the three population areas of the County. Obviously operation without any transfer station would cost more than with transfer stations.

CHAPTER III

BACKGROUND

History of Solid Waste Management in Seminole County, Florida

Collection of solid waste in Seminole County is performed by municipaly owned services in some incorporated areas and by private collectors on a non-exclusive franchise basis in some municipalities and the unincorporated areas of the County.[5] Collectors are not required to use a specific transfer station which results in their using the one that best accommodates the collection route of the day. Some collectors operate in both Orange and Seminole Counties and are free to dispose of their loads at a transfer station of their choosing. Table 1 lists collectors disposing solid wastes in Seminole County.[6]

Seminole County utilizes three transfer stations, one each serving the three population density centers within the County (see Figure 1). The Sanlando transfer station receives the bulk of refuse generated and is located at the old Altamonte Springs landfill. The Upsala transfer station west of Sanford in the Northern part of the County is under-utilized, however, this could change radically should the city of Sanford have to close its existing landfill located at the Sanford airport. The Oviedo transfer station has only a 5 cubic yard hopper and is limited in the amount of solid waste it

TABLE 1

COLLECTORS DISPOSING SOLID WASTES IN SEMINOLE COUNTY

Publicly Maintained Collectors

Altamonte Springs
Eatonville (Orange County)
Maitland (Orange County)
Oviedo
Sanford
Winter Park (Orange County)

Privatly Owned Collectors

American Refuse Service
Better Garbage Service
Central Service Company
C & H Garbage Service
Dump All Inc.
Evans Garbage Service
H & W Refuse Service
Ogburns Garbage Service
Reliable Garbage Service
Seminole Garbage Service
T & K Sanitation Service
Weeks Garbage Service
East Colonial Refuse

SOURCE: Seminole County, Florida, Solid Waste Management Report First Report of Solid Waste Management Team, (Sanford, Florida, May, 1976), p.12.

can handle. Transfer station site selection evolved as a result of natural evolution and not by any planned design or long range plan optimizing cost effectiveness. The three sites were previously landfills that were required to cease operations.

The present Osceola sanitary landfill, an abandoned airfield, evolved because of its availability and remoteness from developed areas. The firm of Clark, Dietz and Associates completed a design and feasibility study for Seminole County in September 1970 which indicated the landfill area would be acceptable to the Florida Department of Environmental Regulation (former Florida Department of Pollution Control) providing that the landfill facility be constructed according to the plan and utilizing a system for permanent dewatering of the entire placement area. Cost limitations prevented the County from implementing important provisions of the design plan which has resulted in citations from the Florida Department of Environmental Regulation. Currently, efforts are underway to re-evaluate the feasibility of redesigning the landfill area to meet State standards. Of the original 1200 acres, it is estimated that only 100 have been used to date and that sufficient acreage remains that could be used providing test wells indicate positive results and that appropriate measures be taken to prevent leachate from entering the groundwater.

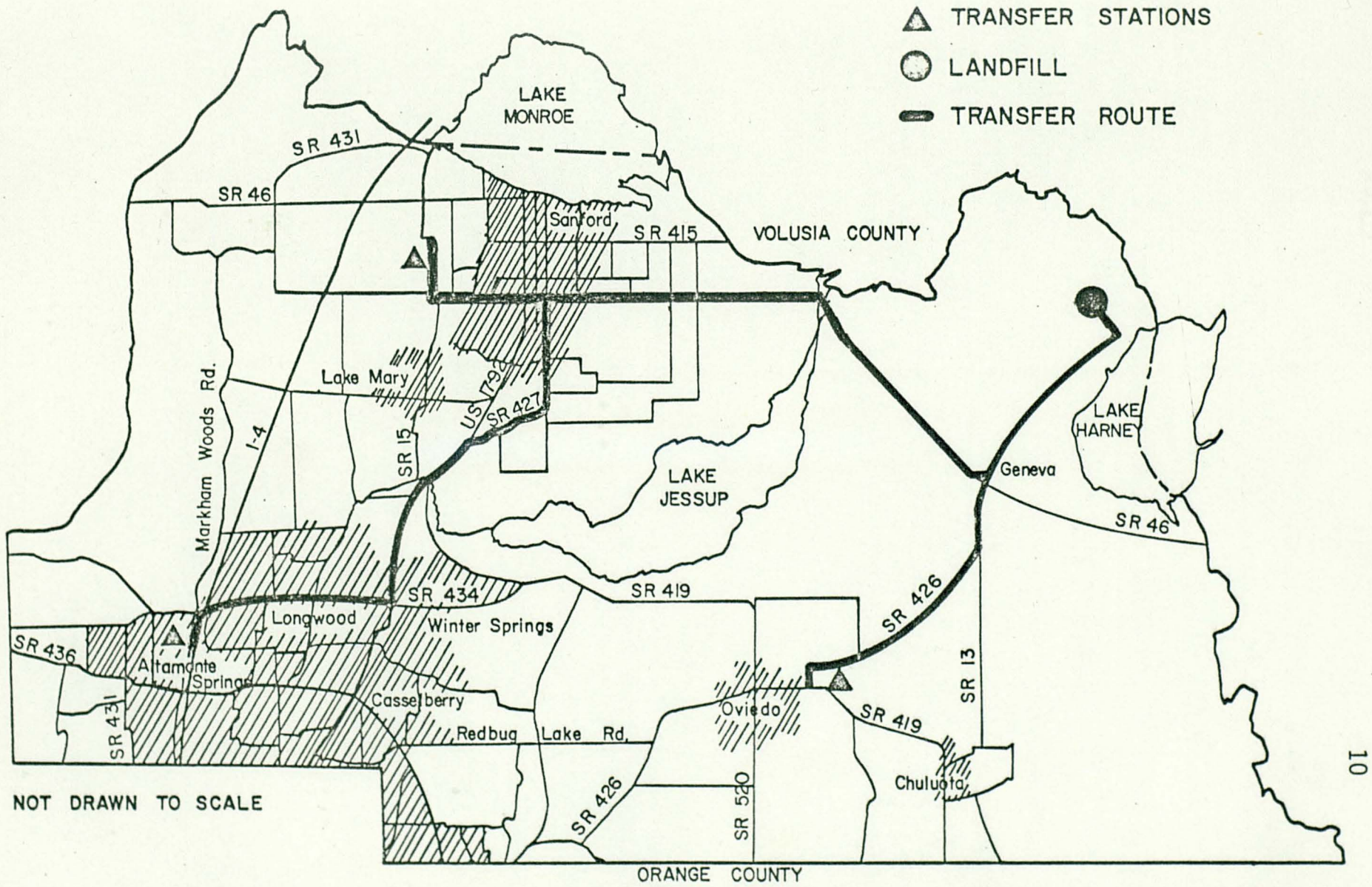

Fig. 1. Seminole County Existing Transfer Stations and Transfer Routes to Osceola Landfill

SOURCE: Seminole County, Florida, Solid Waste Management Report First Report of Solid Waste Management Team (Sanford, Florida, May 1976), p. 17.

Population and Land Use

The population of Seminole County has increased from 83,000 in 1970 to nearly 137,000 in 1975.[7] Population projections of the East Central Florida Planning Council and the Bureau of Business and Economic Research of the University of Florida plan 3 which forecast development along the Longwood-Sanford corridor and outward from Casselberry toward Oviedo reflects a population growth of approximately 4%/year for a 1990 estimate of 251,000 people.[8] Plan 3 appears to be realistic when relating future development to environmentally sensitive areas of the County (see Figure 2).[9]

Transportation Systems

The major highway routes along with State and County roads are depicted on Figure 2. Interstate Highway 4 (I-4) traverses the Western half of the County from north to south and U. S. Highway 17-92 which parallels I-4 four miles to the East is the major business highway between the cities of Orlando in Orange County and Sanford in Seminole County. Numerous State roads crisscross the County and are interconnected by County and municipally maintained roads throughout the County.

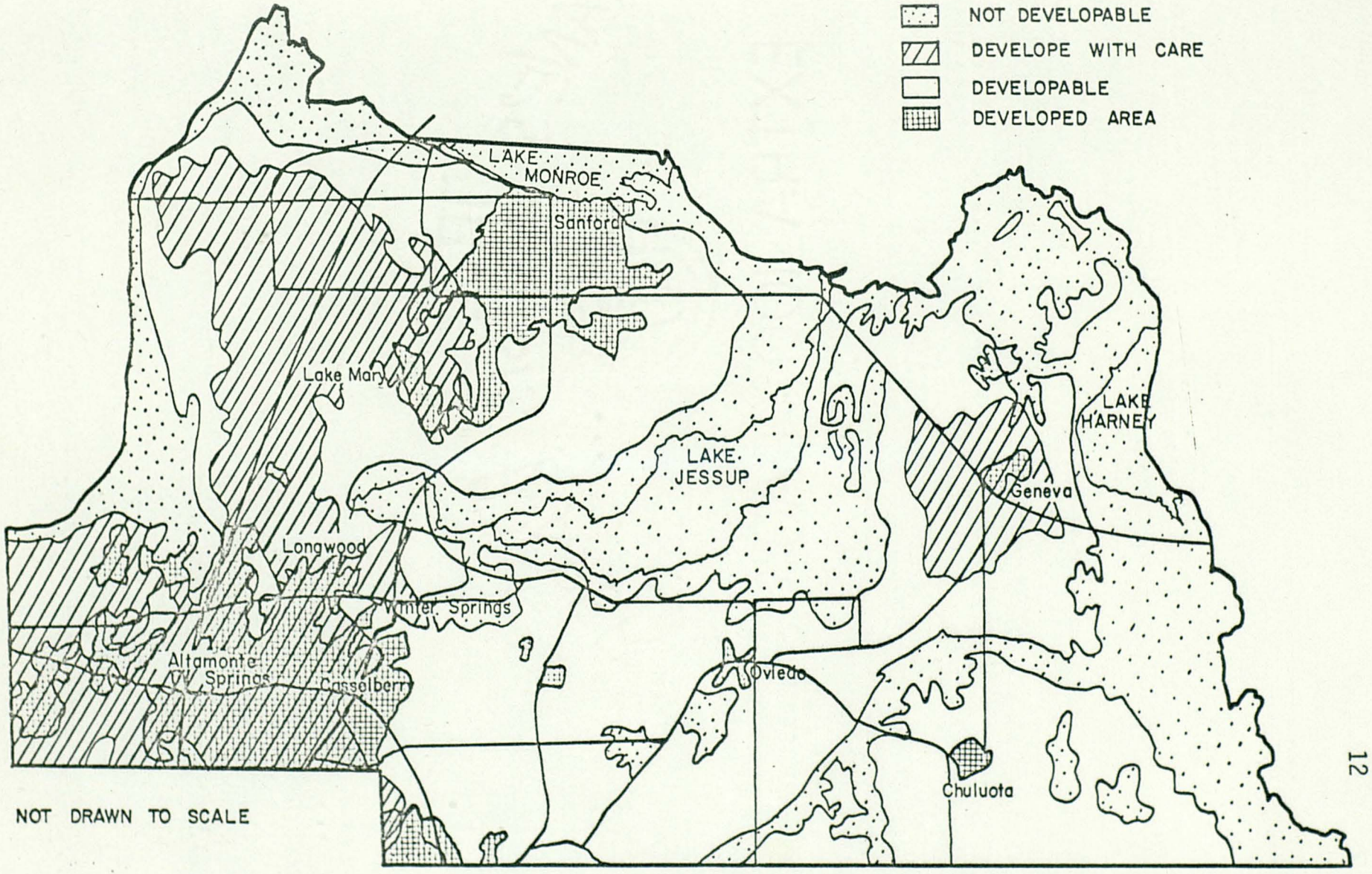

Fig. 2. Seminole County Environmentally Sensitive Areas and Existing Developed Areas of County

SOURCE: Seminole County, Florida, Comprehensive Plan, An Analysis of Resources and Conservation Issues (Sanford, Florida, August 1975), p. viii.

CHAPTER IV

DATA BASE

Existing Population Distribution

Seminole County can be divided into three general population areas (see Figure 3). Area 1, the highly developed Southwestern part of the County includes the municipalities of Altamonte Springs, Casselberry, Longwood, and Winter Springs. Area 2, the sparsely populated rural eastern half of the County has 3 small communities, Oviedo, Chuluota, and Geneva. Area 3, the northern part of the County west of Lake Jessup has 2 major population centers, Sanford and Lake Mary.

For the purposes of this study each of the three population areas was subdivided into waste generation districts as shown in Table 2 and depicted in Figure 4. Criteria for selecing the generation district was existing traffic zone boundaries, corporate integrity of individual municipalities were also used. There were occasions due to corporate irregularities when unincorporated portions of the County were included along with municipalities.

The waste generation areas have been given names according to the major city or town to assist the reader in assimilating population and waste load information with geographical significance.

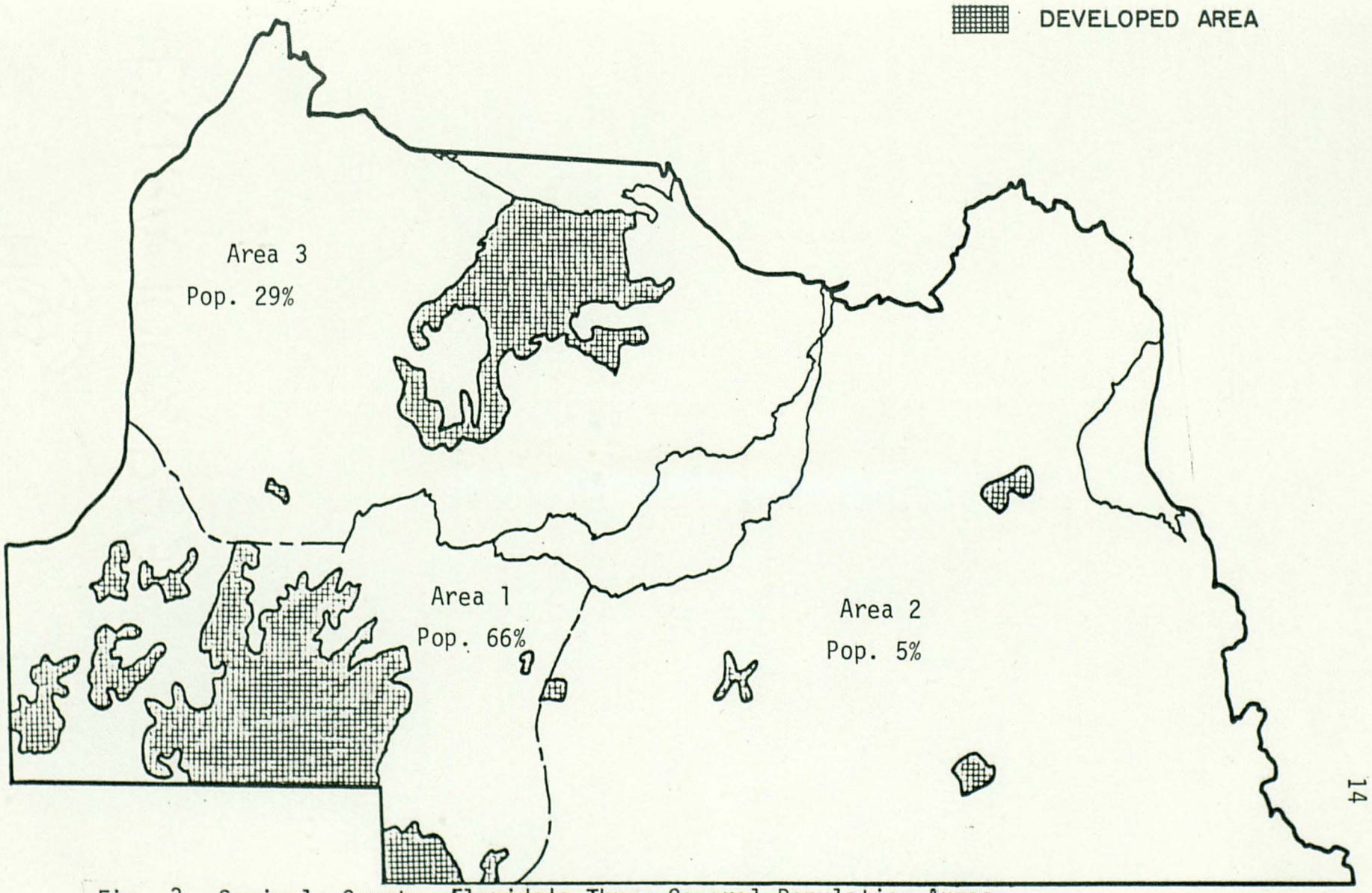

Fig. 3. Seminole County, Florida's Three General Population Areas.

TABLE 2

WASTE GENERATION DISTRICTS

Area	Name
1	Wekiva Springs
2	Altamonte Springs
3	Praire Lake
4	Casselberry
5	Longwood
6	Winter Springs
7	Fern Park
8	Oviedo
9	Chuluota-Geneva
10	Lake Jessup
11	Lake Mary
12	Idlewilde
13	Heathrow
14	Sanford
15	Eatonville-Maitland
16	Winter Park

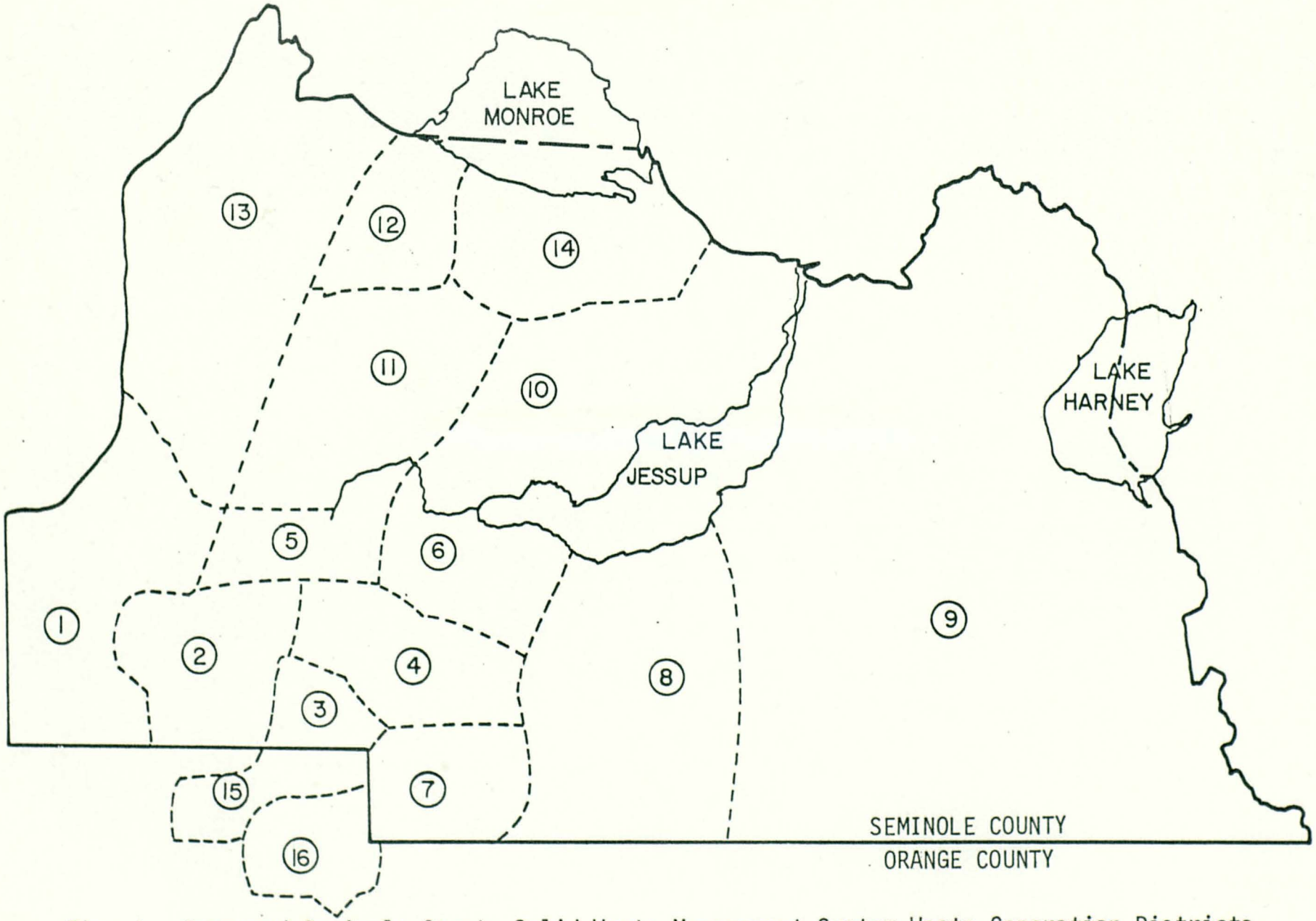

Fig. 4. Proposed Seminole County Solid Waste Management System Waste Generation Districts

Existing Collection Practices

There are 13 privately owned and three municipally operated collectors that collect solid waste from commercial and residential sources in Seminole County. The private firms operate under "Certificates of public convenience and necessity" authorized and issued in accordance with Seminole County Ordinance No. 70-3.

Current practices of disposing of the solid waste by the collecting agencies and firms is to offload at one of three transfer stations located in each of the three population areas of the County.

Since private collectors operate under non-exclusive franchises and frequently operate in both Orange and Seminole County it is not unusual to have solid waste generated in one County yet disposed in the other. Under the present system neither County restricts the use of their disposal facilities. Three Orange County cities who maintain public collection services utilize the Sanlando transfer station to dispose of their solid waste. The city of Sanford in Northern Seminole County operates its own collection and disposal facilities.

Existing Disposal Practices

Current disposal practices in Seminole County exclusive of the city of Sanford relies upon the use of transfer stations for consolidating the generated solid waste prior to transporting the waste in 75 C.Y. transfer trailers to the Osceola sanitary landfill located in the Northeastern sector of the County. Discussions with

County personnel at the landfill confirms that very little solid waste is received by other than County operated transfer vehicles.

Since most solid waste passes through transfer stations while the amount delivered directly to the landfill by generators is deemed insignificant, County records (OMAE Rpt Form 2) can be used to compile the necessary tonnage generated by those contributing to the system. A review of these forms for the period from January through June 1976, a period representative of one half the cold-dry season and one-half the hot-wet season, provides base data needed to compute a per capita generation rate. OMAE Form 2's for the period reflect the following:

Month	No. Trips	Trips/Working Day
January	499	19
February	502	21
March	616	23
April	569	22
May	548	21
June	553	21
Total	3287	

To estimate the per capita generation rate on a weight basis it is necessary to convert the 3287 trips by the 75 C.Y. trailors into tonnage. Since Seminole County has no facilities available for routinely weighing its vehicles, an acceptable weight/load relationship had to be established. A check with solid waste officials in both Brevard and Orange County was made since both routinely weigh

similar transfer trailer vehicle loads in their operations. Their records, as reported to this writer reflect a range from 15 to 17 tons per trip and averaged 16 tons per trip. A discussion with Bill Petus, Seminole County Solid Waste Superintendent, revealed that occassionally on busy days, trailers were topped out at the Sanlando transfer station (approximately 1 out of 8) in order to keep unloading vehicles from having long delays waiting for pit space. A check of topped out loads revealed a weight of 22.5 tons.[10] Taking the occasional topping out of trailers into consideration an additional 0.6 tons was added to the average load in order to arrive at a reasonable weight:trip ratio for Seminole County transfer trailers loads of 16.6 tons/trip.

The population that contributed to the solid waste stream included all residents of Seminole County less the city of Sanford but including the populations of Eatonville, Maitland and Winter Park from Orange County. The Seminole County contributors are estimated at 115,650 while those from Orange County at 34,750 for 1976.[11]

From the following established data, a per capita generation rate was calculated.

1. 3287 trips at 16.6 tons/trip for 54,564 tons for the 6 month period. Since the 6 month period is representative of one-half the year, multiplying by 2 gives an assumed generation of 109,128 tons for 1976.
2. Converting tons into pounds and dividing by the contributing

population, a per capita per year generation amounts to 1451.2 lbs/year. On a daily basis this works out to 3.98 lbs. per person per day (lbs./p/d).

The 3.98 lbs./p/d solid waste generation rate compares favorably with a previous finding by this writer for both Brevard and Orange County whose populations generated 4.06 lbs/p/d during the past year.[12]

Projected Population and Solid Waste Generation

Tables 4, 5, 6 and 7 show the projected population and solid waste generation for Seminole County and those areas of Orange County who may continue to be included in the Seminole County Solid Waste Disposal Plan. Solid waste projections are based upon a 2% yearly net increase while population projections for Seminole County include a 4% yearly increase and the more highly developed areas of Orange County reflecting a 2% yearly increase.

Sanitary Landfill Acreage Requirements

Of the 1200 acres at the Osceola landfill approximately 100 have been used for solid waste disposal. The remaining 1100 acres could be used for waste disposal and should accommodate the anticipated waste load through the year 1990 providing a modified trench-highrise operation is implemented. Landfill acreage required is based upon the following criteria:

1. An 8 foot layer of compacted solid waste
2. Solid waste compacted to 1000 pounds per cubic yard

3. Six inch intermediate soil cover
4. Two feet of final soil cover
5. 28% additional acreage required for roads, trenches, perimeter ditches, utilities, building site, and stabilization ponds. Higher than average acreage was assumed because of unsuitable land.

Required acreage is calculated as follows:

TPCD = tons per collected day

$$\left(\frac{2000\#/TPCD}{1000\#/C.Y.}\right)\left(\frac{27\ C.F./8\ F^{*}}{C.Y.}\right)\left(\frac{312\ Days^{**}/YR\ X\ 14\ YRS\ X\ 1.28}{43560\ S.F./Acre}\right)$$

Acreage required per TPCD = 0.87 Acres

* 8F - eight foot layer of solid waste

** 312 Days - 312 collection days per year

TABLE 3

LANDFILL ACREAGE REQUIRED THROUGH 1990

PLAN	1976 PER CAPITA GENERATION 4#/p/d	5.3#/p/d	6.68#/p/d
Seminole County Less Sanford	561.8	750.6	965.1
Seminole County	670.4	895.3	1151.2
Seminole County Less Sanford but including Orange County Cities	682.0	910.8	1171.1
Seminole County and Orange County Cities	790.6	1049.5	1357.2

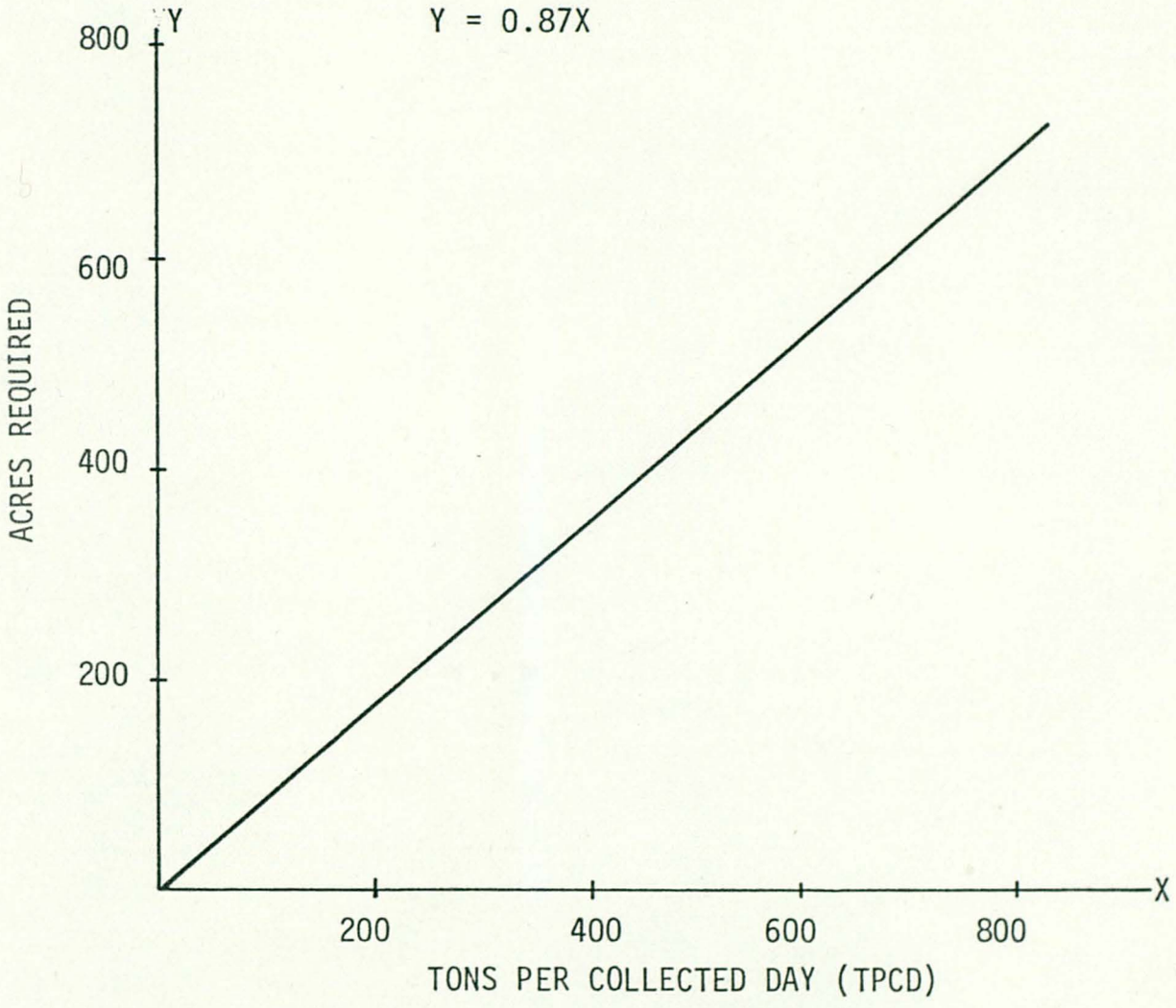

Fig. 5. Landfill Acreage Required For Modified Trench-Highrise Sanitary Landfill.

TABLE 4

POPULATION PROJECTIONS

AREA	YEAR 1976	1981	1986	1990
1	12775	15543	18910	22111
2	21268	25876	31482	36840
3	10052	12230	14879	17413
4	17017	20704	25189	29459
5	11114	13522	16451	19225
6	13367	16263	19786	23158
7	9590	11668	14196	16604
8	5567	6773	8240	9642
9	1345	1636	1991	2332
10	1198	1458	1773	2069
11	12750	15512	18873	22084
12	4695	5712	6950	8132
13	906	1103	1343	1570
Sub-Totals	121,644	148,000	180,063	210,639
14	23466	28550	34736	40628
County Totals	145,110	176,550	214,799	251,267
15	10608	11712	12931	14000
16	23469	25912	28609	30967
Seminole Cty. + Orange Cty. Contributors	179,187	214,174	256,339	296,234

TABLE 5

SOLID WASTE GENERATION
AT 4 LBS/P/D AND A 2% NET INCREASE/YEAR

AREA	TONS PER DAY 1976	1981	1986	1990
1	25.4	34.1	45.9	58.0
2	42.4	56.8	76.4	95.8
3	20.0	26.9	36.1	45.7
4	33.9	45.5	61.1	77.3
5	22.1	29.7	39.9	50.5
6	26.6	35.7	48.0	60.8
7	19.1	25.6	34.4	43.6
8	11.1	14.9	20.0	25.3
9	2.7	3.6	4.8	6.1
10	2.4	3.2	4.3	5.4
11	25.4	34.1	45.8	58.0
12	9.3	12.5	16.9	21.3
13	1.8	2.4	3.3	4.1
Sub Totals	242.2	325.0	438.9	551.9
14	46.6	62.8	82.2	106.6
Sub Totals	288.8	387.8	521.1	658.5
15	21.1	25.7	31.4	36.8
16	46.7	56.9	69.4	81.3
TOTALS	356.6	470.4	621.9	776.6

TABLE 6

SOLID WASTE GENERATION

AT 5.3 LBS/P/D AND A 2% NET INCREASE/YEAR

AREA	TONS PER DAY 1976	1981	1986	1990
1	33.9	45.5	61.1	77.4
2	56.4	75.6	101.6	129.0
3	26.6	35.8	48.1	60.9
4	45.0	60.6	81.2	103.2
5	29.5	39.6	53.1	67.3
6	35.4	47.6	64.0	81.0
7	25.4	34.1	45.9	58.1
8	14.8	19.8	26.6	33.7
9	3.6	4.8	6.4	8.2
10	3.2	4.3	5.7	7.2
11	33.8	45.4	61.0	77.3
12	12.4	16.7	22.4	28.5
13	2.4	3.2	4.3	5.5
Sub Totals	322.4	433.0	581.4	737.3
14	62.2	83.6	112.2	142.2
Sub Totals	384.6	516.6	693.6	879.5
15	28.1	34.3	41.8	49.0
16	62.2	75.8	92.4	108.4
TOTALS	474.9	626.7	827.8	1030.9

TABLE 7

SOLID WASTE GENERATION
AT 6.8 LBS/P/D AND A 2% NET INCREASE/YEAR

AREA	TONS PER DAY 1976	1981	1986	1990
1	43.4	58.3	78.4	99.5
2	72.4	97.0	130.4	165.8
3	34.2	45.9	61.7	78.4
4	57.8	77.6	104.4	132.6
5	37.8	50.7	68.2	86.5
6	45.6	61.0	82.2	104.2
7	32.6	43.8	58.8	74.7
8	18.9	25.4	34.2	43.4
9	4.6	6.1	8.3	10.5
10	4.1	5.5	7.3	9.3
11	43.4	58.2	78.2	99.4
12	16.0	21.4	28.8	36.6
13	3.1	4.1	5.6	7.1
Sub Totals	413.9	555.0	746.5	948.0
14	79.8	107.0	144.0	182.8
Sub Totals	493.7	662.0	890.5	1130.8
15	36.1	43.9	53.6	63.0
16	79.8	97.2	118.6	139.4
TOTALS	609.6	803.1	1062.7	1333.2

CHAPTER V

SYSTEMS COST

The purpose of this chapter is to provide cost comparisons of the present transfer station operation with alternate transfer station site configurations within the County while utilizing the same Osceola landfill for final solid waste disposal.

Transfer Station Capital Costs

The present system has three transfer stations in the following areas: Sanlando, Upsala, and Oviedo. Since most equipment at the transfer stations is approaching the end of its useful life[13], the cost of restoring the existing transfer stations to acceptable standards approximates the cost of building a new facility. Capital cost curves for the existing or new facilities are assumed to be the same.

A present worth capital cost curve for transfer stations was established by determining the cost for a 50, 100 and 500 ton per day facility. The equipment needed for each of the three waste loads per day was determined along with personnel requirements and anticipated maintenance and administrative cost. Table 8 lists the assumptions used for calculating the cost of a transfer station. (See also Fig. 6.)

Tractor/trailer costs for 1976 are based upon data supplied by Earl Melvine, Brevard County Solid Waste Supervisor.[14] Facility requirements and costs were based on data provided in "Estimating

TABLE 8

TRANSFER STATION REQUIREMENTS

STATION CAPACITY	50 TPD		100 PTD		500 TPD	
Transfer Vehicle Round Trip	1 Hour	2 Hour	1 Hour	2 Hour	1 Hour	2 Hours
Required Equipment						
Tractor(s)	1	1	1	2	6	10
Trailer(s)	1	1	2	2	10	16
Facilities						
Building	30' X 30'		40' X 40'		110' X 75'	
Transfer Equipment						
Compactor	1		1		2	
Hopper	1		0		0	
Conveyor	0		1		1	
Pits	0		0		2	
Scale	1		1		1	
Operation & Maintenance						
Personnel						
Packer	1		1.5		2.5	
Driver	1		1.5	2	6	10
Gate Attendant	0		0		2	
Clean Up	0		0		2	
Facility Maintenance @ $8000/unit*						
Number of Units	1		1		2	
Administrative Cost @ 7.5% Personnel and Maintenance Cost.						

SOURCES: Estimating the Cost of a Transfer Station, Fred Pregerio, Waste Age Vol. 5, No. 4, July 1974, pp. 6-9.

*Interview with Bill Petus, Seminole County Solid Waste Supervisor, Sanford, Fl., August 2, 1976.

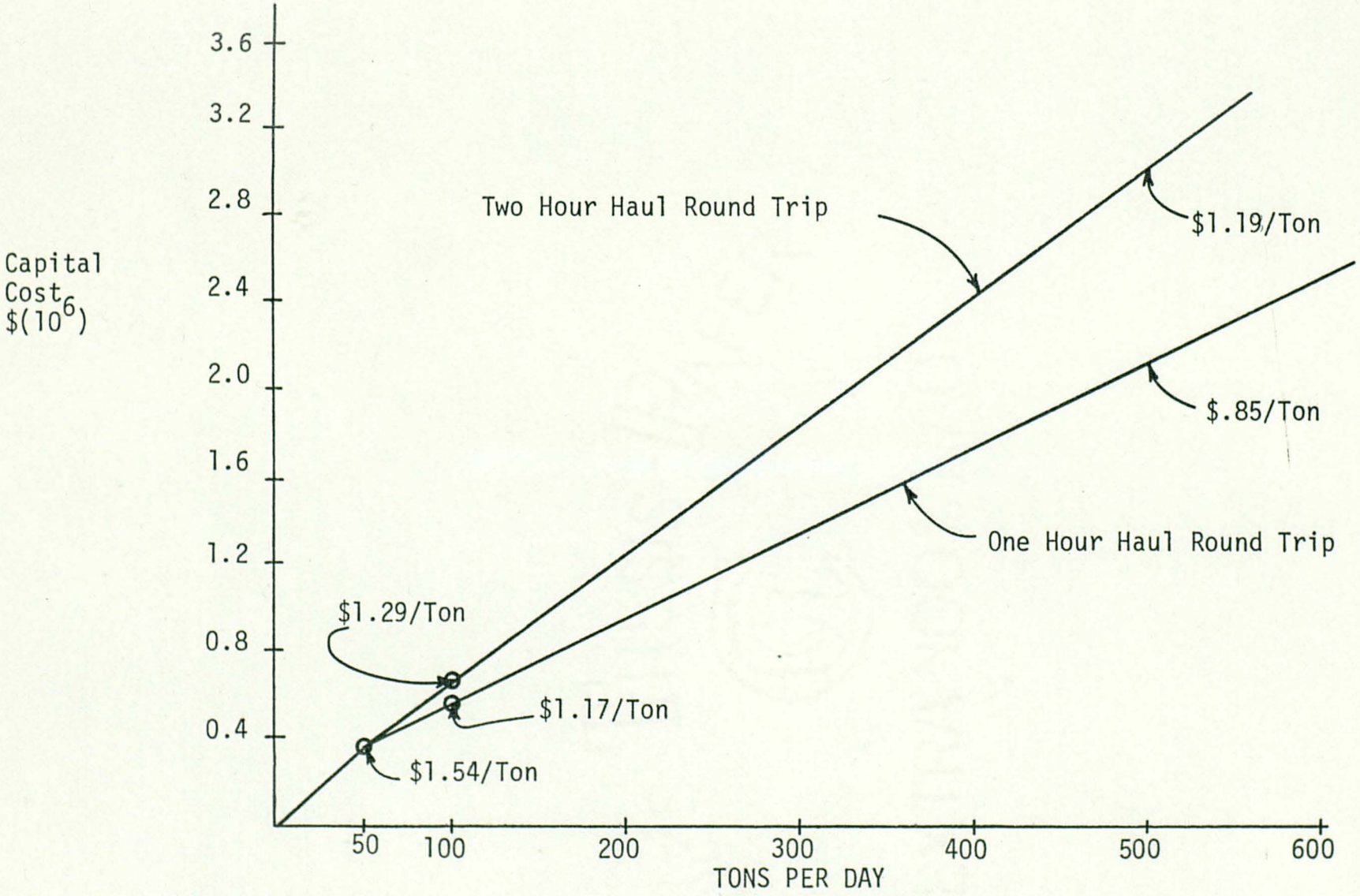

Fig. 6. Transfer Station Capital Cost

the Cost of a Transfer Station".[15] Costs were adjusted for inflation and reflect 1976 prices.

Table 9 lists the present worth costs for each facility and includes a recommended vehicle replacement schedule of 5 years for tractors and trailers, inflation rate of 8% was used for a period of 14 years through the design year 1990.

Transfer Vehicle Operating and Maintenance Costs

Transfer vehicle operating costs which include fuel, oil, tires, maintenance, insurance and licenses amounts to $0.31/mile.[16] Figure 7 shows the cost per mile as a function of tons per day of solid waste hauled to the landfill and assumes 15 tons per vehicle trip, and a six day work week.

Landfill Capital Costs

Preliminary investigation of the Osceola landfill site indicates the need for extensive expense that would include, redesign, site development, facilities for on-site personnel and administration, and equipment commensurate with the anticipated daily solid waste load. Since the anticipated waste load is not known at this time, a cost curve (Figure 8) was developed for planning purposes and is based upon progressively increasing solid waste loads. Table 10 list items of equipment required for different waste load capacities. Table 11 lists the present worth capital costs for all items deemed essential to design and operate a sanitary landfill in accordance with acceptable standards. Cost data has been adjusted taking into

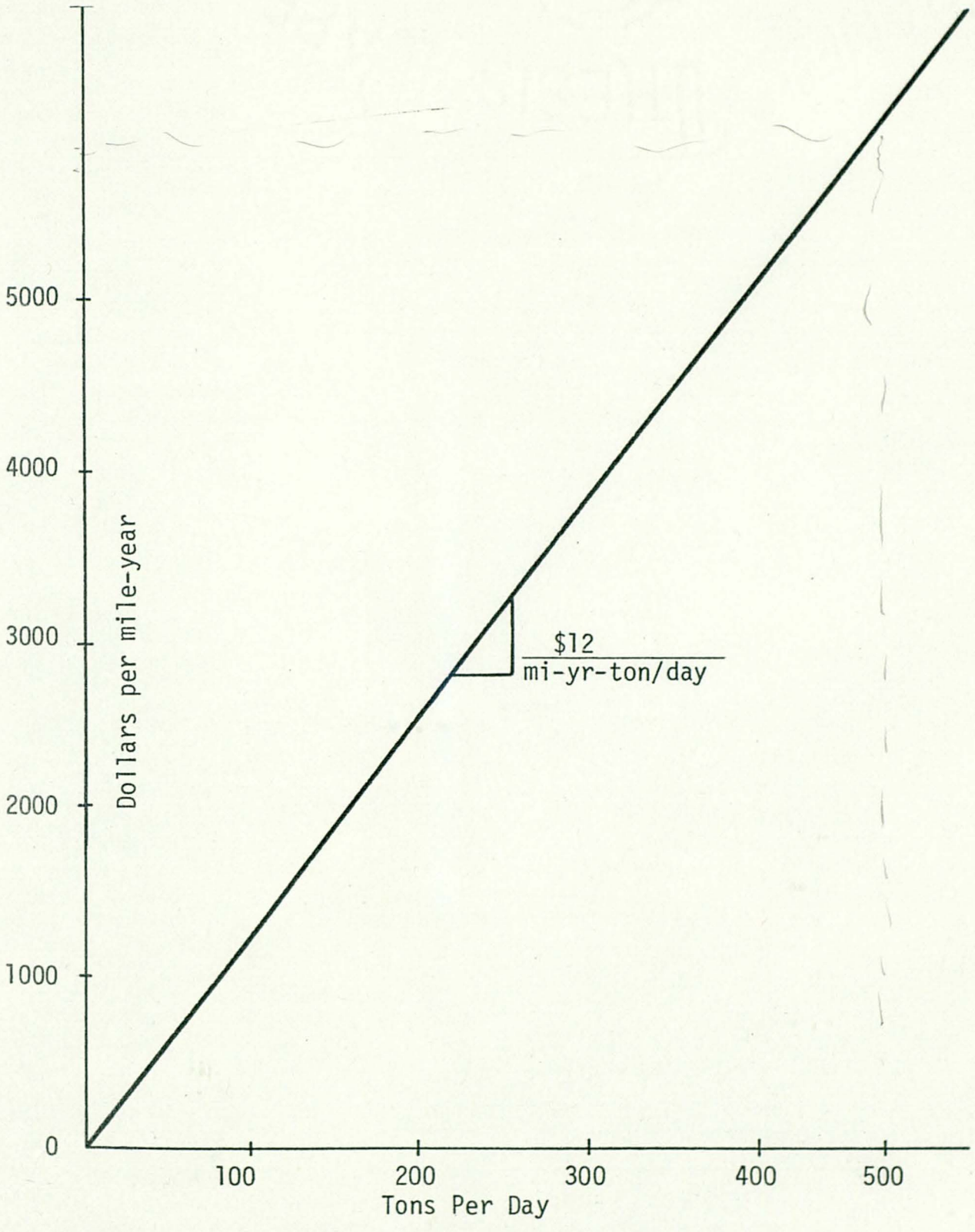

Fig. 7. Transfer Vehicle Operating Cost.

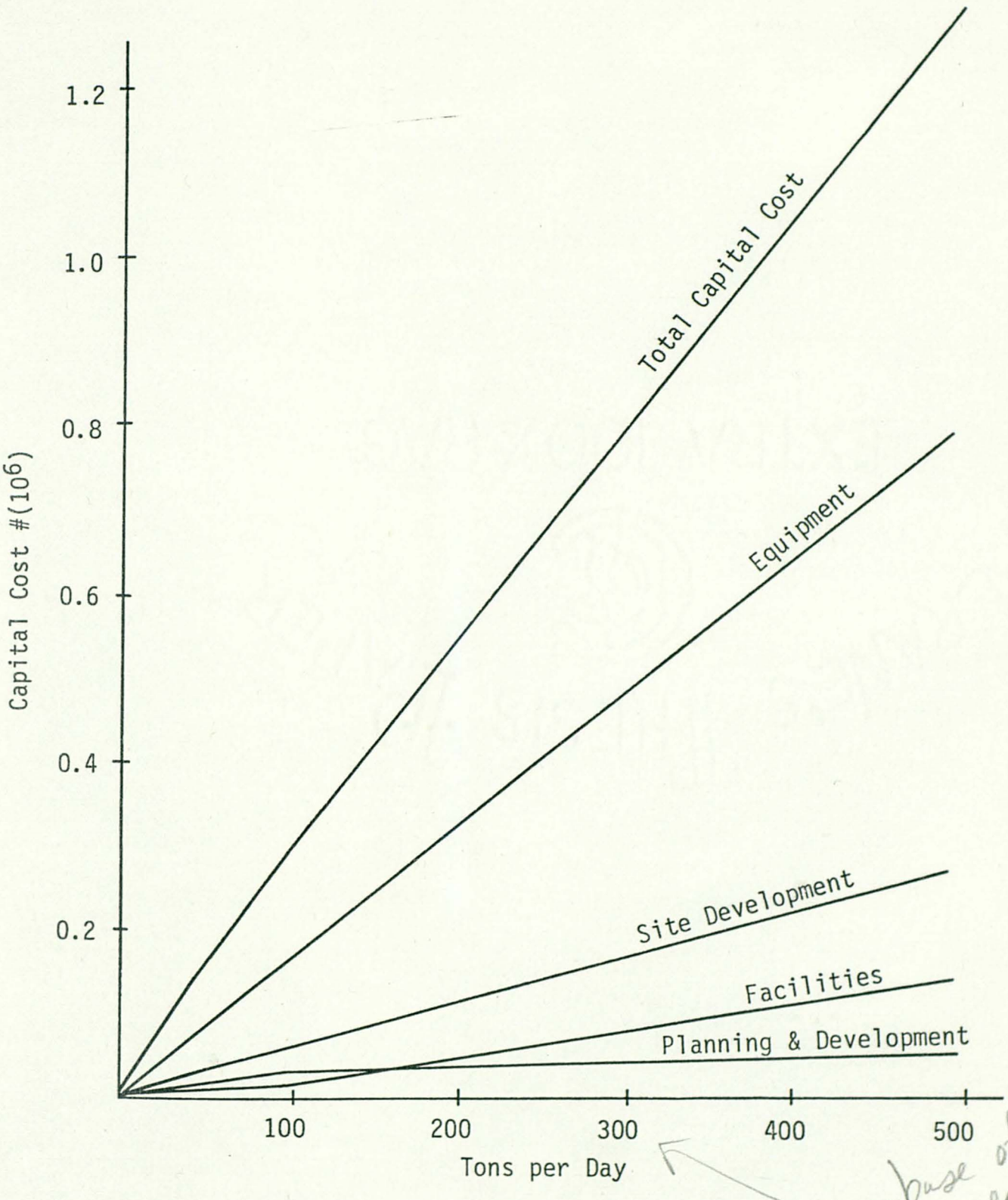

Fig. 8. Osceola Sanitary Landfill Capital Cost Curve

TABLE 9

TRANSFER STATION CAPITAL COSTS

STATION CAPACITY	50 TPD		100 TPD		500 TPD	
Transfer Vehicle Round Trip	1 Hour	2 Hour	1 Hour	2 Hour	1 Hour	2 Hour
Transfer Trailers*						
Trailer $21,000.ea.						
Tractor $32,000.ea.						
1976 - 1981	$ 53,000	$ 53,000	$ 97,000	$ 106,000	$ 402,000	$ 656,000
1981 - 1986 (P/F,8%,5yr)	$ 33,401	$ 33,401	$ 61,129	$ 66,801	$ 253,340	$ 413,411
1986 - 1990 (P/F,8%,10yr)	$ 24,550	$ 24,550	$ 44,930	$ 49,099	$ 186,206	$ 303,859
Facilities**	$ 40,000	$ 40,000	$ 65,260	$ 65,260	$ 273,059	$ 273,059
Operations & Maintenance***						
Personnel (P/A,8%,14yr)	$160,500	$160,500	$240,750	$ 280,875	$ 840,160	$1,161,162
Maintenance (P/A,8%,14yr)	$ 65,952	$ 65,952	$ 65,952	$ 65,952	$ 131,904	$ 131,904
Administration (P/A,8%,14yr)	$ 16,984	$ 16,984	$ 23,003	$ 26,012	$ 72,905	$ 96,980
TOTALS	$394,387	$394,387	$598,024	$ 659,999	$2,159,574	$3,036,375

SOURCE: *Interview with Earl Melvine, Brevard County Solid Waste Supervisor, Merritt Island, FL., July 28, 1976.

**Estimating the Cost of a Transfer Station, Fred Pregerio, Waste Age Vol. 5, No.4, July, 1974, pp. 6-9.

***Interview with Bill Petus, Seminole County Solid Waste Supervisor, Sanford, FL., August 2, 1976.

TABLE 10

SUGGESTED SANITARY LANDFILL EQUIPMENT REQUIREMENTS

ITEM	LANDFILL CAPACITY - TONS PER DAY		
	50	100	500
Tractor dozer	1 (12 ton)	1 (20 ton)	2 (32 ton)
PAN			1 (11 C.Y.)
Dragline			1 (1.5 C.Y.)
Compacter			1 (30 ton)
Water Truck			1
Water Pumps	1	1	3

SOURCE: U. S. Environmental Protection Agency, Sanitary Landfill Design & Operation, Solid Waste Series Publication No. SW-65ts (Washington, D.C.: Government Printing Office), 1972, pp. 39-47.

TABLE 11

SANITARY LANDFILL CAPITAL COST

ITEM	LANDFILL CAPACITY - TONS PER DAY		
	50	100	500
Planning & Design	$ 20,000	$ 32,000	$ 55,000
Site Development	$ 36,000	$ 65,000	$ 280,000
Facilities	$ 15,000	$ 25,000	$ 150,000
Equipment*	$ 69,459	$173,648	$ 813,571
TOTAL	$140,459	$295,648	$1,298,571

*Equipment items needed based upon a 5 year replacement cycle with exception of dragline which is replaced at 10 years.

SOURCE: U. S. Environmental Protection Agency, Decision-Makers Guide in Solid Waste Management, Solid Waste Series Publication No. SW-60 (Washington, D.C.: U. S. Government Printing Office), 1976, pp. 109-117.

consideration current landfill conditions and equipment on hand.

Landfill Operating and Maintenance Costs

An operating and maintenance cost curve (Figure 9) was developed which considered equipment operating cost from Table 12, personnel salaries based upon existing Seminole County wage rates currently in use (Table 13), miscellaneous costs for tolls, building maintenance, supplies, etc., and administrative costs at 7.5% of the above which is the current Seminole County practice of estimating and budgeting administrative costs.[17]

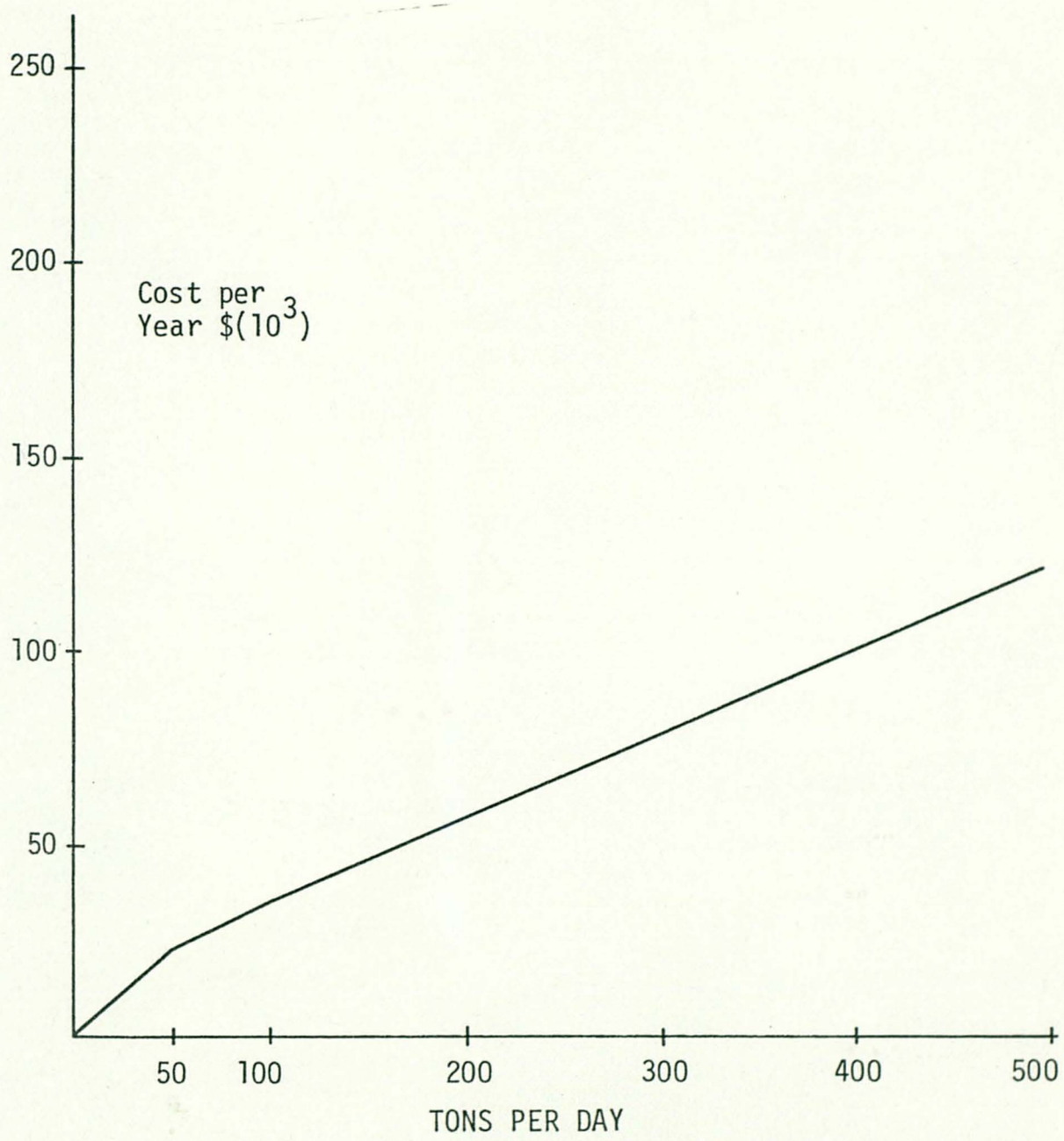

Fig. 9. Osceola Sanitary Landfill Operating and Maintenance Cost Curve.

TABLE 12

SANITARY LANDFILL EQUIPMENT OPERATING COST

ITEM	HOURS/DAY	$ RATE/HOUR	$ COST/DAY
Dozer 1	8	4	32
Dozer 2	4	4	16
Compacter	8	4	32
PAN	4	4	16
Dragline	8	4	32
Water truck	4	2	8
TOTAL			136

SOURCE: U. S. Environmental Protection Agency, Sanitary Landfill Design & Operation, Solid Waste Series Publication No. SW-657s (Washington, D.C.: Government Printing Office), 1972, p. 47.

TABLE 13

SANITARY LANDFILL PERSONNEL COSTS

POSITION	LANDFILL CAPACITY-TONS PER DAY		
	50	100	500
Foreman-Operator			$10,483
Operator-dozer	$9,984	$ 9,984	$ 9,984
Operator-compacter			$ 9,984
Operator-dragline			$10,483
Laborer		$ 6,390	$ 6,390
Spotter-truck driver			$ 6,390
Supervisor			$15,000
TOTALS	$9,984	$16,374	$68,714

NOTE: Wages based upon current Seminole County wage scale plus 20% for insurance, benefits, etc., as provided by Bill Petus

TABLE 14

SANITARY LANDFILL OPERATING AND MAINTENANCE COSTS

ITEM	LANDFILL CAPACITY-TONS PER DAY		
	50	100	500
Equipment	$9,984	$ 9,984	$42,432
Personnel	$9,984	$16,374	$68,714
Misc. Costs @ 10¢ ton	$1,825	$ 3,650	$18,250
Administration* @ 7.5% of above cost	$1,635	$ 2,251	$ 9,705

*Current Seminole County practice of computing administrative costs as reported by Bill Petus.

CHAPTER VI

COMPUTER PROGRAM

In evaluating the alternatives for solid waste transfer and disposal, a computer model "SOLWASTE" provided by Dr. Martin P. Wanielista of Florida Technological University at Orlando was used.

The computer program uses mixed interger techniques and a hueristic algorithm to determine an optimum solution. The model includes costs of transporting waste from the centroid of the solid waste generation districts to a transfer station along with subsequent costs for delivery to the landfill. The model optimizes selection of transfer station sites by comparing the overall costs through a series of iterations. All costs associated with the construction and operation of transfer stations and the sanitary landfill for the model are shown in Tables 9, 11 and 14 and Figures 6, 7, 8 and 9.

Four computer models were evaluated for optimum transfer site selection. Each varied in the number of waste generating areas contributing to the solid waste stream. The models were also evaluated at three different per capita waste generation rates which provided essential optimized solutions useful in developing present worth cost curves that would be useful for decision makers in considering the population districts to either include or exclude in a comprehensive solid waste management program for Seminole County.

The four models, plan A, B, C, and D are defined as follows:

Plan A — All of Seminole County excluding the city of Sanford and including the cities of Eatonville, Maitland, and Winter Park from Orange County.

Plan B — All Seminole County and the cities of Eatonville, Maitland, and Winter Park from Orange County.

Plan C — All of Seminole County.

Plan D — Seminole County excluding the city of Sanford.

Plan A

Alternative 1 as depicted in Figure 10 is the present solid waste management system with transfer stations at Sanlando, Upsala, and Oviedo. The present cost of this alternative is $11,509,784. which results in a cost per ton of $3.36. Table 15 lists the amount of solid waste in tons per collected day that could be expected to pass through each transfer station for the design year. The tons per collected day (TPCD) are based upon per capita generation rates as indicated and reflect a six day collection week.

Alternative 2 as depicted in Figure 11 has a present worth cost of $12,468,648. and reflects an increase to $3.64/ton should the Oviedo transfer station be eliminated.

Alternative 3 shown in Figure 12 indicates a present worth cost of $12,314,545. with the use of only one transfer station at Sanlando. While this would indicate a savings over alternative 2, it would still be $0.14/ton more than by using the three existing transfer stations.

TABLE 15

PLAN A PRESENT WORTH COST PER TON FOR DESIGN YEAR 1990

TRANSFER STATION	DESIGN CAPACITY TONS PER DAY COLLECTED (TPCD) 5.25#/p/d	7#/p/d	9#/p/d
	Alternate 1		
Sanlando	592	790	1015
Upsala	104	139	178
Oviedo	88	117	150
TOTALS	784	1046	1343
Present Worth $/Ton	3.361	3.305	3.268
	Alternate 2		
Sanlando	680	907	1165
Upsala	104	139	178
TOTALS	784	1046	1343
Present Worth $/Ton	3.641	3.638	3.621
	Alternate 3		
Sanlando	784	1046	1343
Present Worth $/Ton	3.596	3.569	3.552
	Alternate 4		
Public Works Yard	784	1046	1343
Present Worth $/Ton	3.941	3.923	3.906
	Alternate 5		
Longwood	784	1046	1343
Present Worth $/Ton	3.629	3.601	3.583

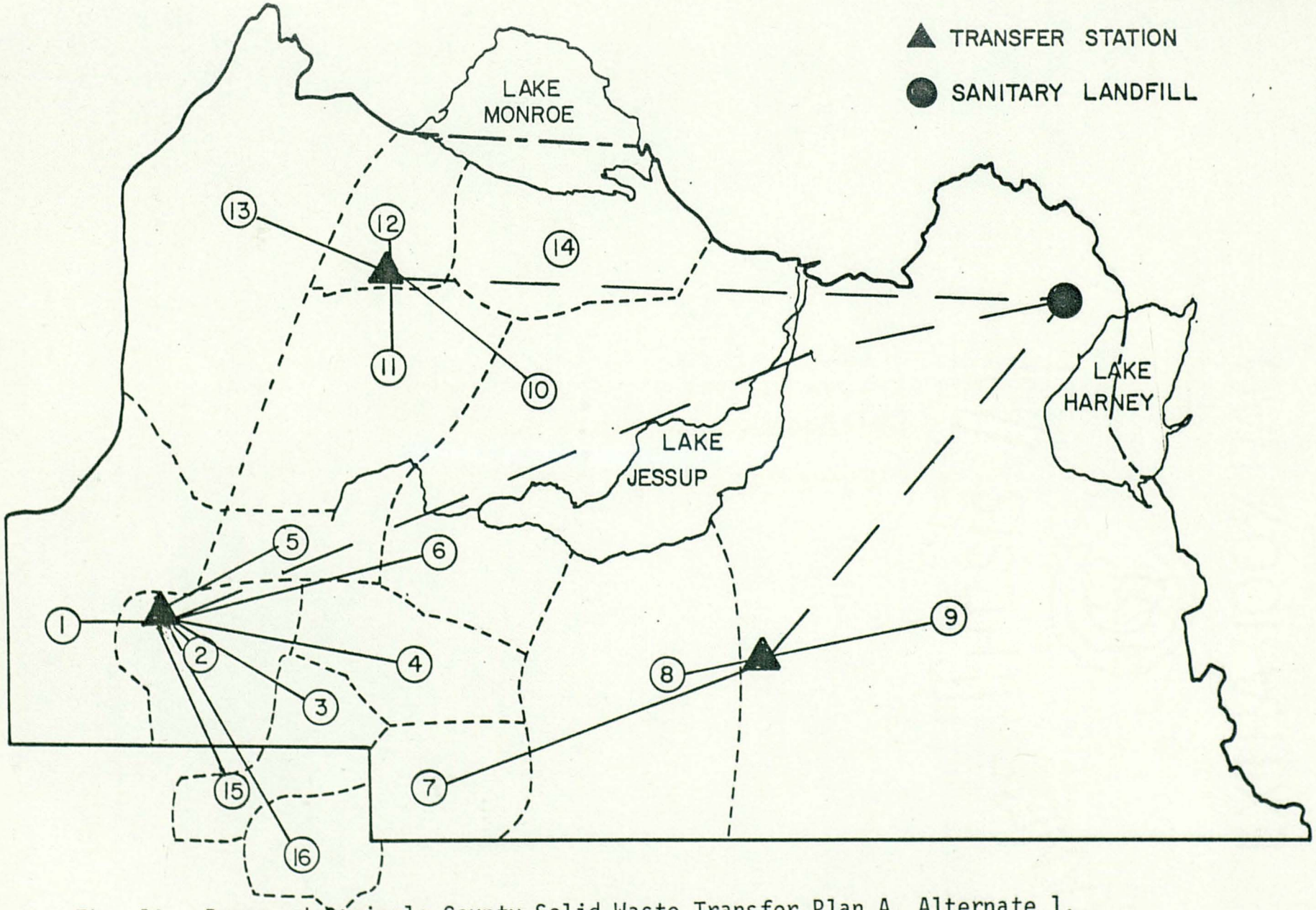

Fig. 10. Proposed Seminole County Solid Waste Transfer Plan A, Alternate 1.

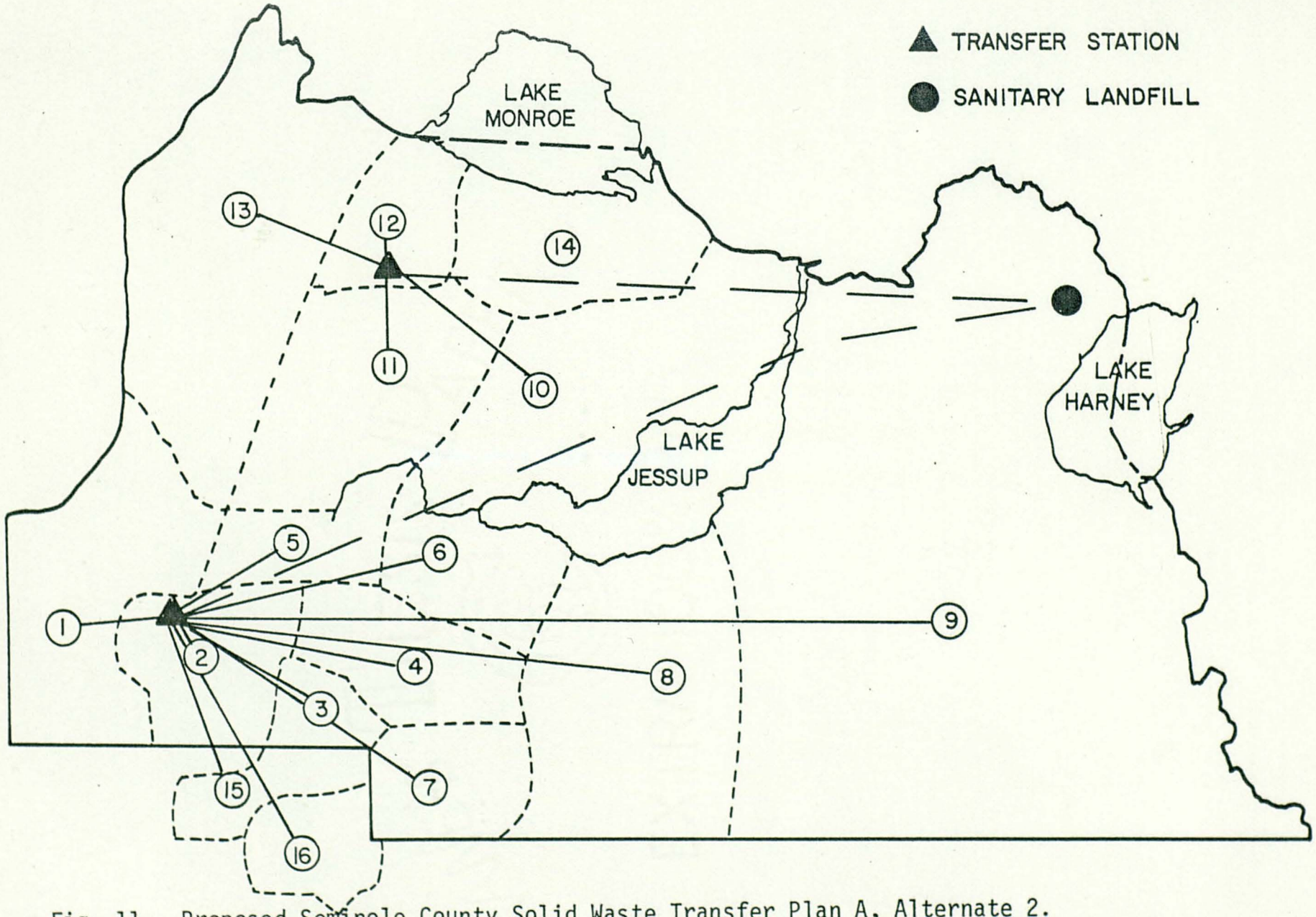

Fig. 11. Proposed Seminole County Solid Waste Transfer Plan A, Alternate 2.

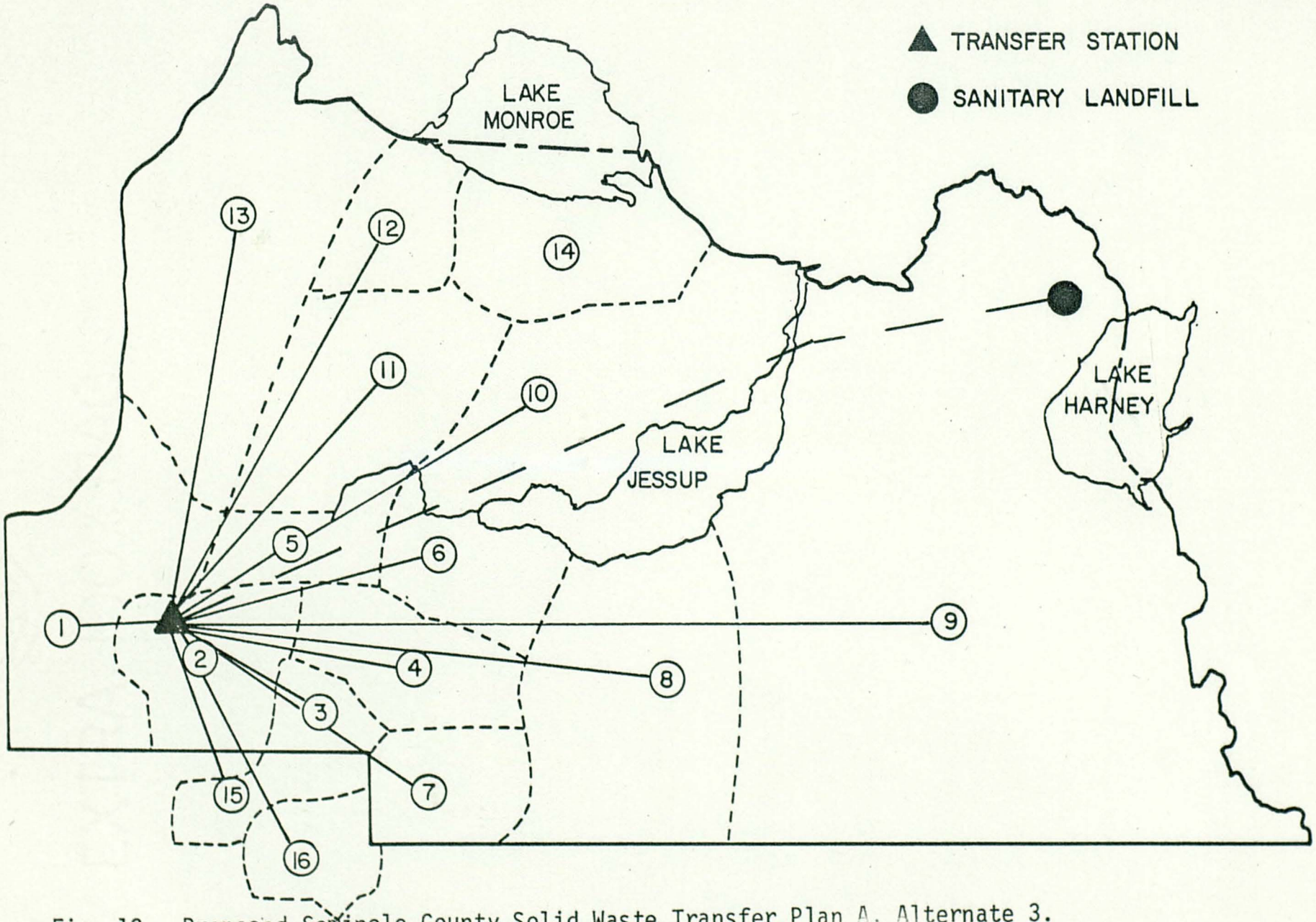

Fig. 12. Proposed Seminole County Solid Waste Transfer Plan A, Alternate 3.

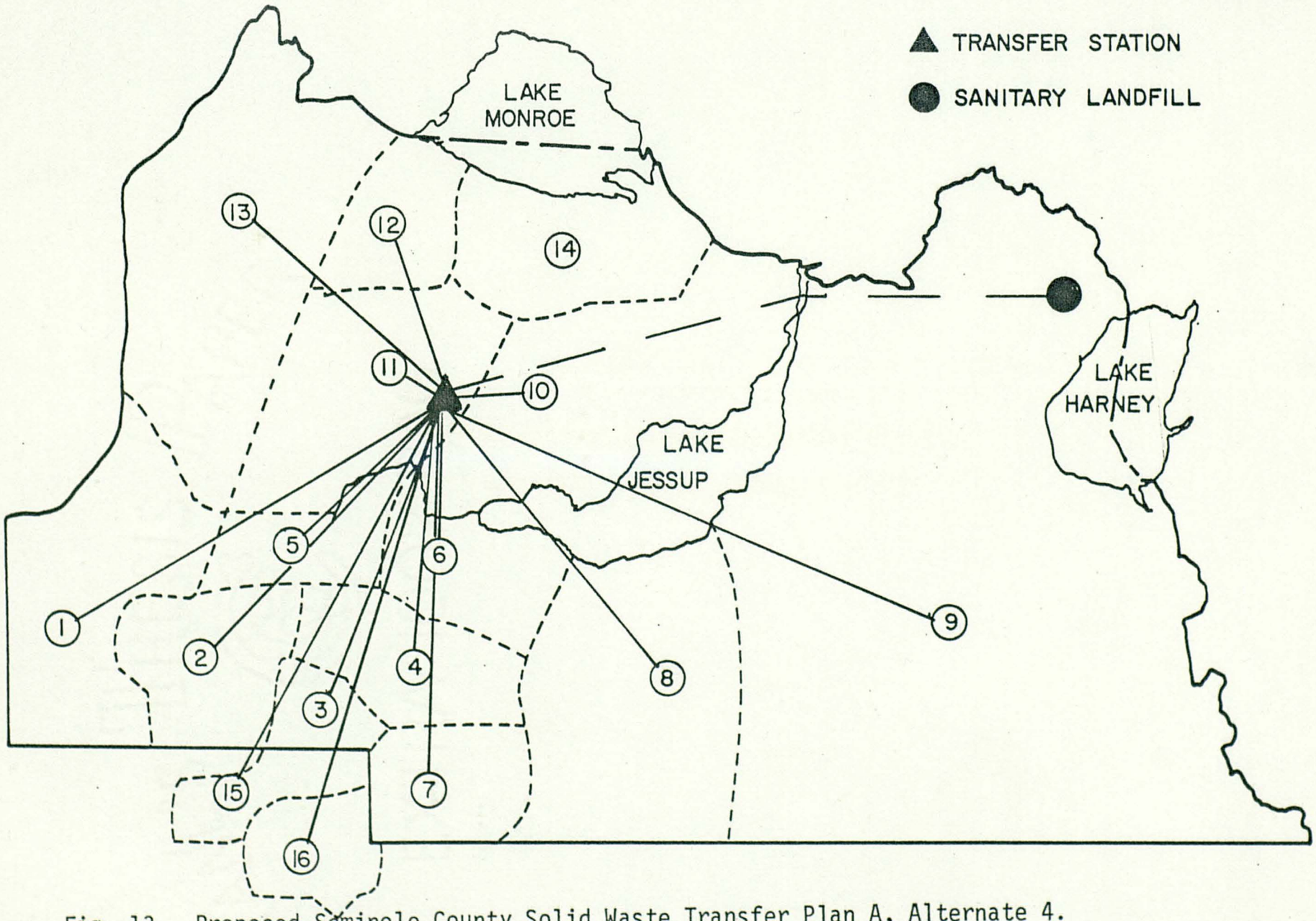

Fig. 13. Proposed Seminole County Solid Waste Transfer Plan A, Alternate 4.

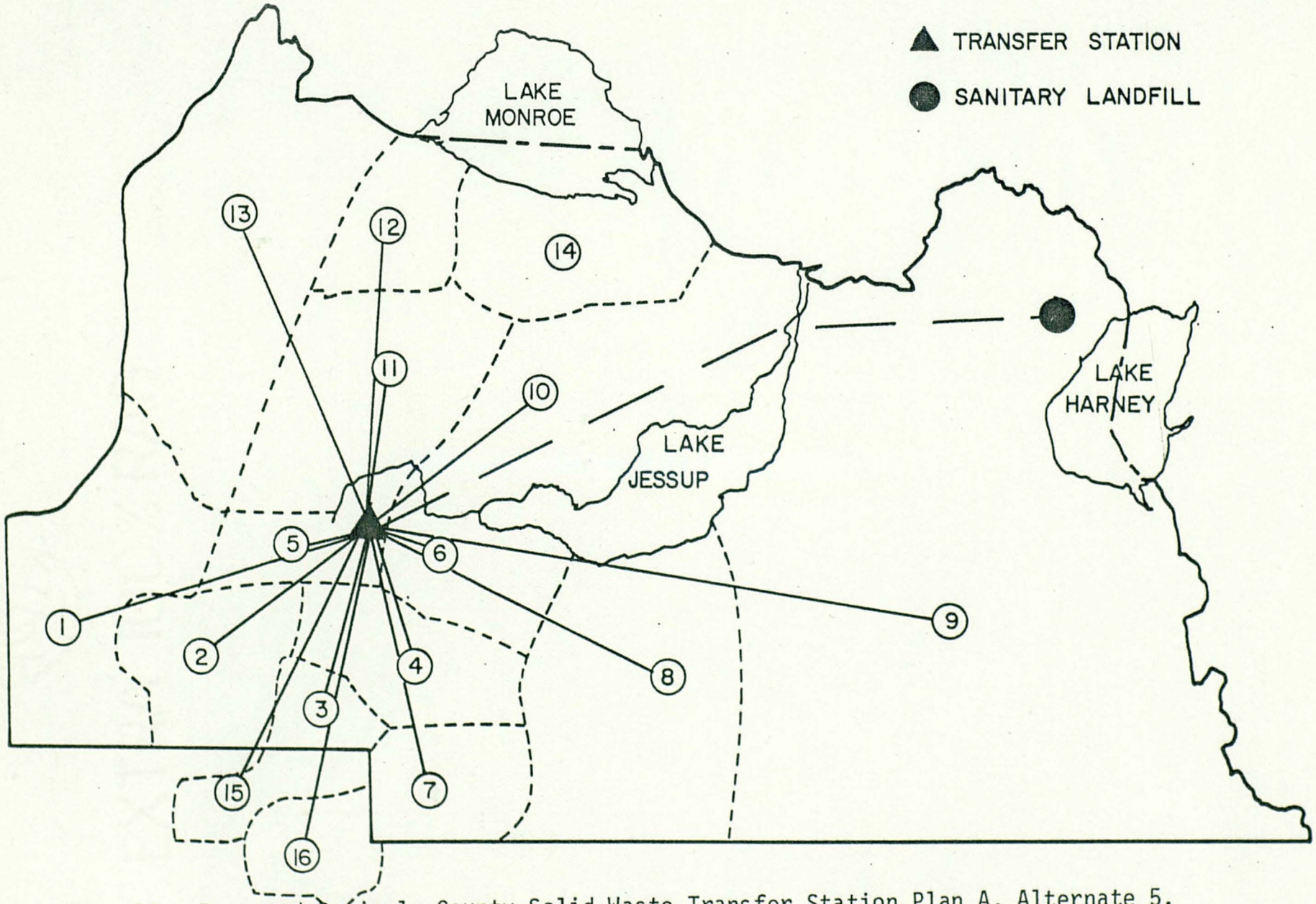

Fig. 14. Proposed Seminole County Solid Waste Transfer Station Plan A, Alternate 5.

Alternative 4 calls for closing the existing three transfer stations and operating a new facility located at the Seminole County Public Works Yard off highway 17-92. This alternate plan has a present cost value of $13,496,001 which converts to $3.94/ton.

Alternate 5 under Plan A was designed with one transfer station off highway 17-92 in Longwood. This alternative with a single transfer station serving the entire generating area has a present cost slightly higher than alternate 3 at $12,427,554.

Plan B

This plan includes the current solid waste contributors as well as the city of Sanford. The transfer station at Upsala was eliminated and a new one programmed at the Sanford Airport while keeping the Sanlando and Oviedo facilities. The present worth cost of this model amounted to $13,082,873 for a $3.30/ton rate. (See Figure 15 and Table 16).

Plan C

Plan 3 denies the use of Seminole County facilities to all collectors from outside Orange County.

Alternate 1 has the current transfer station site configuration as shown in Figure 16 and indicates a present worth cost of $11,314,343 for a cost per ton of $3.36.

Alternate 2 was rearranged to drop the Sanlando transfer station and erect a new one off 17-92 in the city of Longwood as indicated in Figure 17. The present cost for this model is

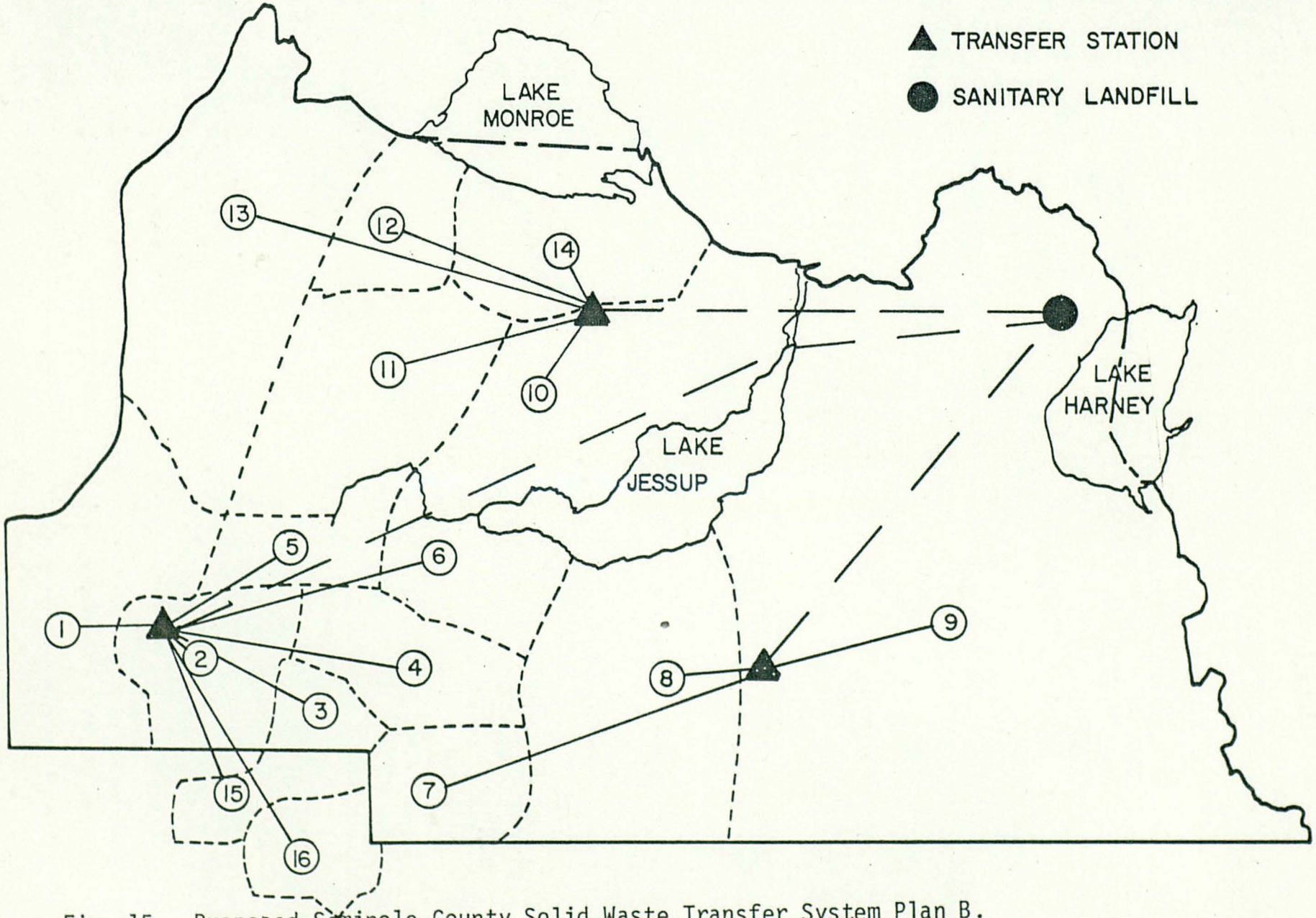

Fig. 15. Proposed Seminole County Solid Waste Transfer System Plan B.

TABLE 16

PLAN B PRESENT WORTH COST PER TON FOR DESIGN YEAR 1990

TRANSFER STATION	DESIGN CAPACITY TONS PER COLLECTED DAY (TPCD) 5.25#/p/d	7#/p/d	9#/p/d
Sanlando	592	790	1015
Sanford Airport	229	305	392
Oviedo	88	117	150
TOTALS	909	1212	1557
Present Worth $/Ton	3.295	3.243	3.210

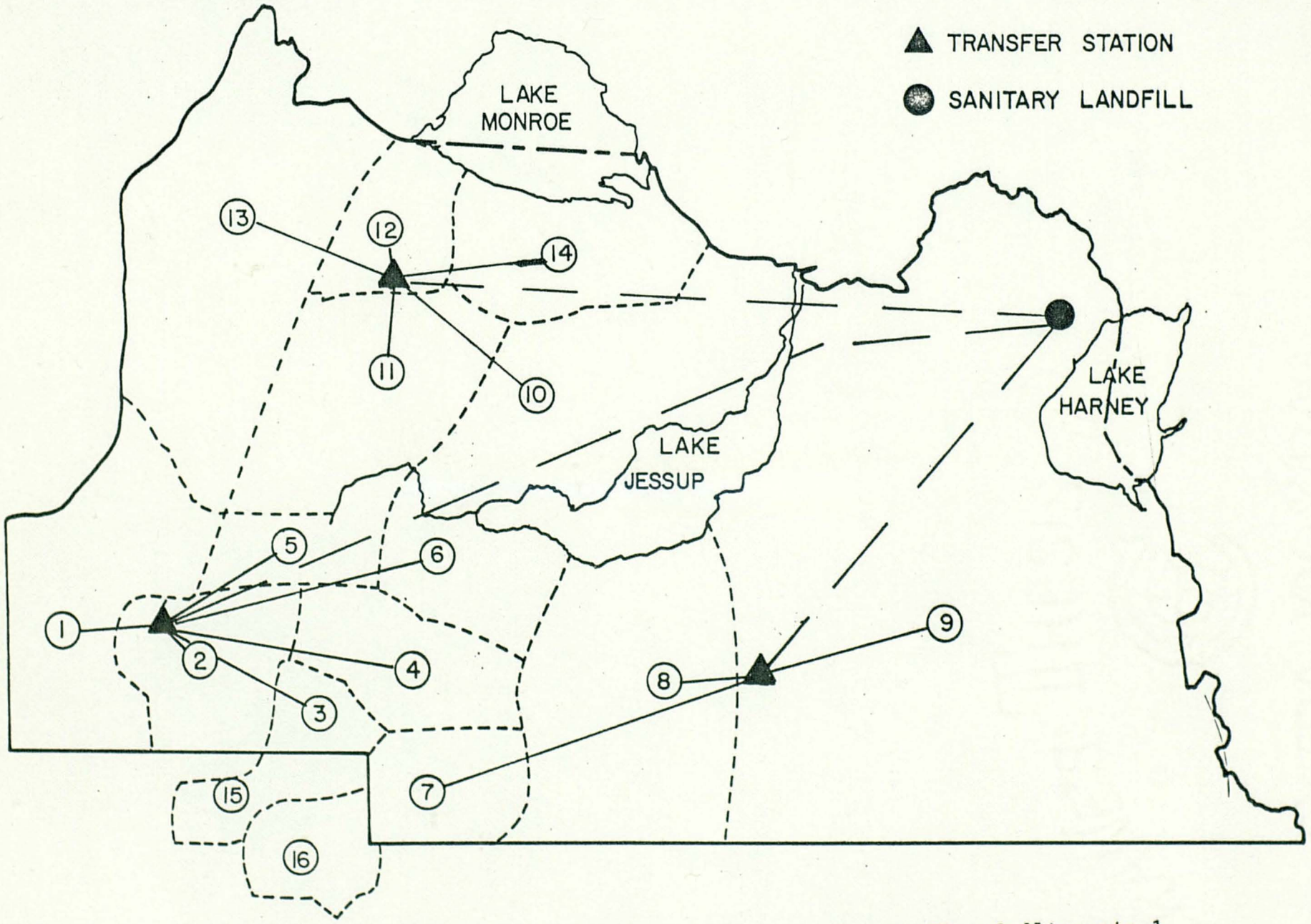

Fig. 16. Proposed Seminole County Solid Waste Transfer System Plan C Alternate 1.

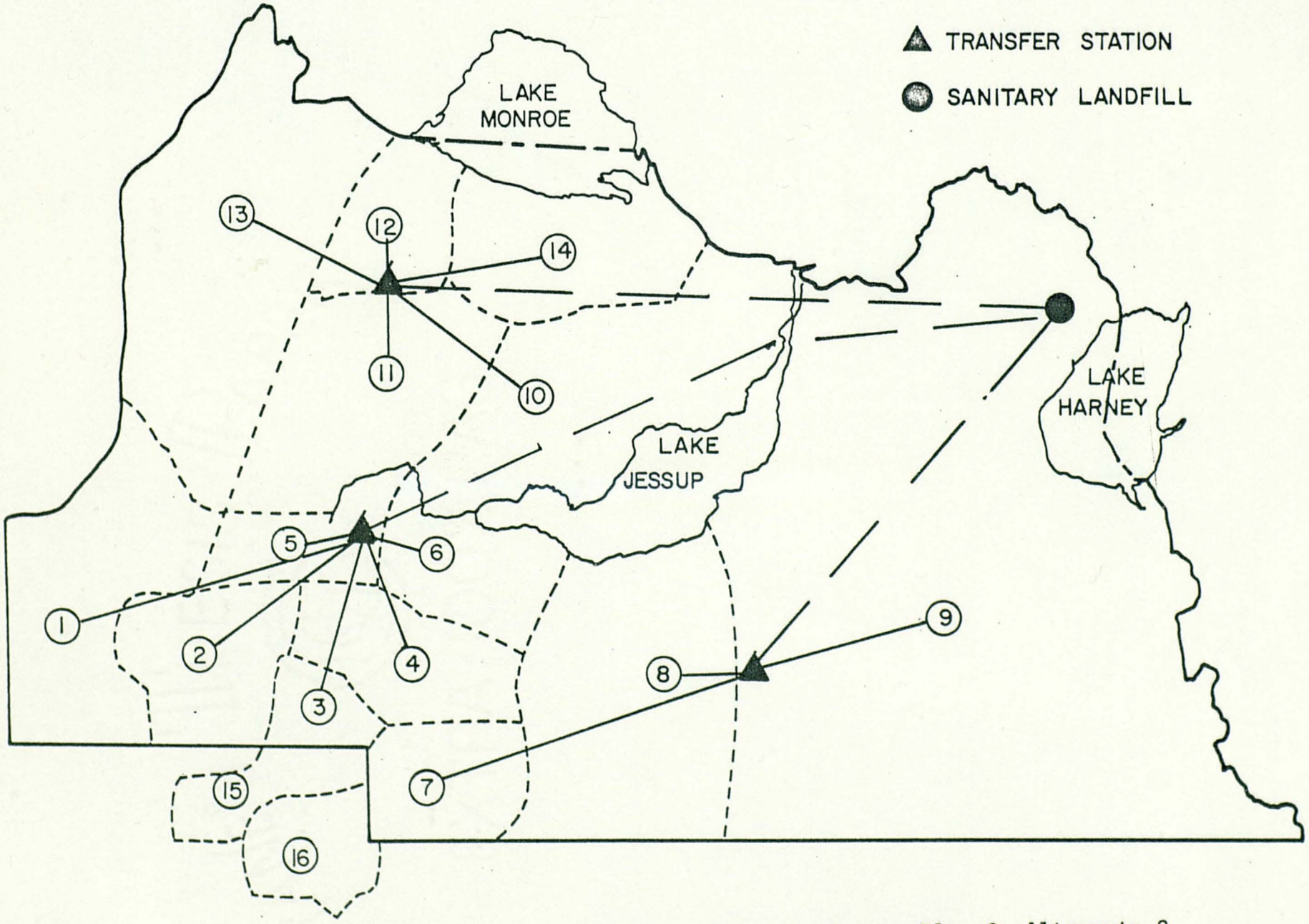

Fig. 17. Proposed Seminole County Solid Waste Transfer System Plan C, Alternate 2.

$12,145,092 for rate of $3.61/ton as shown in Table 17.

Plan D

This model was an attempt to evaluate the solid waste transfer and disposal cost for Seminole County yet excluding the city of Sanford. The Upsala transfer station was eliminated and a new facility erected at the Seminole County Public Works Yard off Highway 17-92. This configuration as shown in Figure 18 generated a present cost of $9,441,502 or a $3.35/ton.

A present worth cost curve dependent upon per capita generation rates and reflecting the cost differences of each plan is shown in Figure 19.

TABLE 17

PLAN C PRESENT WORTH COST PER TON FOR DESIGN YEAR 1990

TRANSFER STATION	DESIGN CAPACITY TONS PER COLLECTED DAY (TPCD) 5.25#/p/d	7#/p/d	9#/p/d
	Alternate 1		
Sanlando	453	607	781
Upsala	229	305	392
Oviedo	88	117	150
TOTALS	770	1029	1323
Present Worth $/Ton	3.364	3.321	3.294
	Alternate 2		
Longwood	453	607	791
Upsala	229	305	392
Oviedo	88	117	150
TOTALS	770	1029	1323
Present Worth $/Ton	3.611	3.515	3.481

TABLE 18

PLAN D PRESENT WORTH COST PER TON FOR DESIGN YEAR 1990

TRANSFER STATION	DESIGN CAPACITY TONS PER COLLECTED DAY 5.25#/p/d	7#/p/d	9#/p/d
Sanlando	324	434	558
Public Works Yard	234	312	401
Oviedo	88	117	150
TOTALS	646	863	1109
Present Worth $/Ton	3.346	3.257	3.212

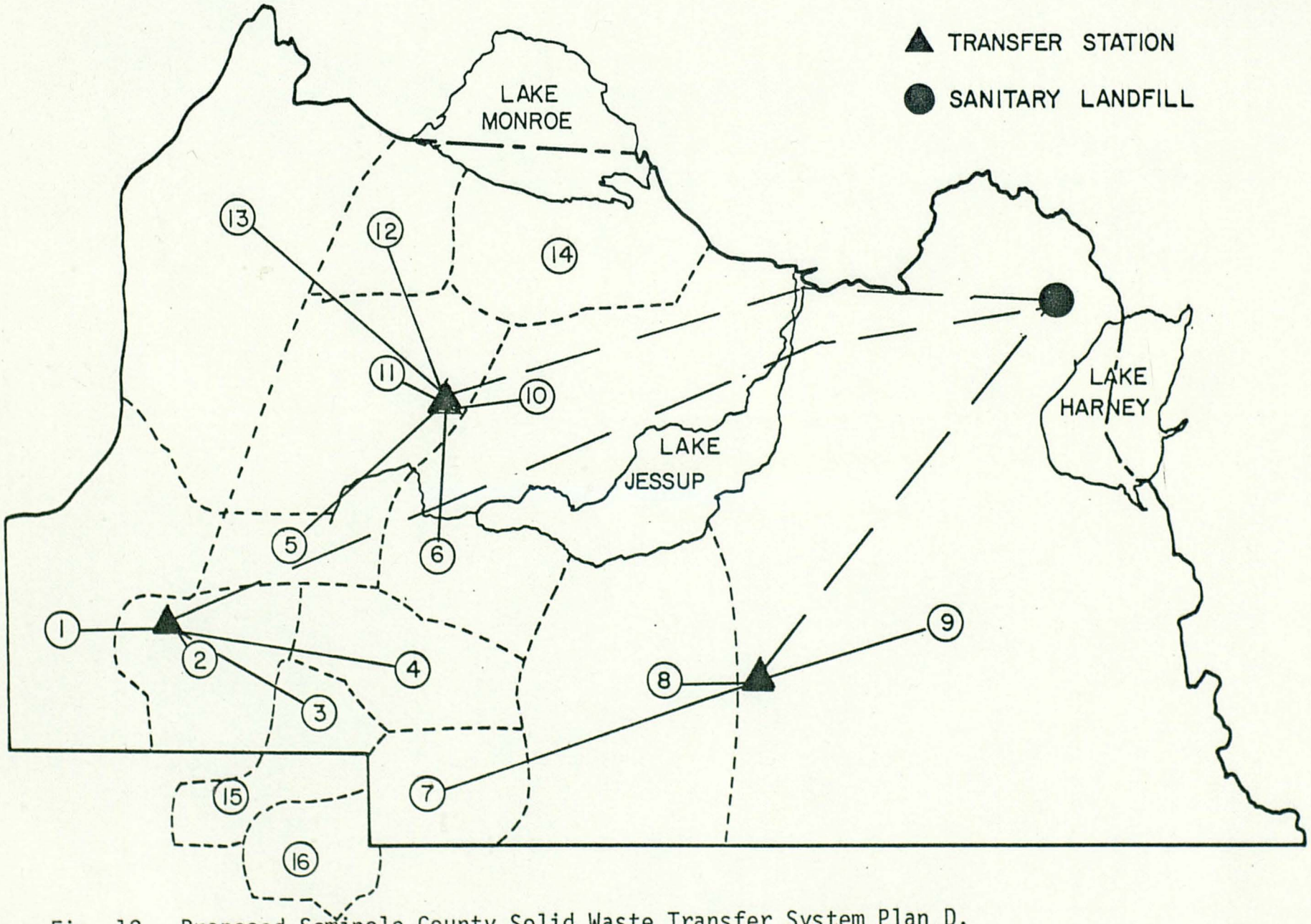

Fig. 18. Proposed Seminole County Solid Waste Transfer System Plan D.

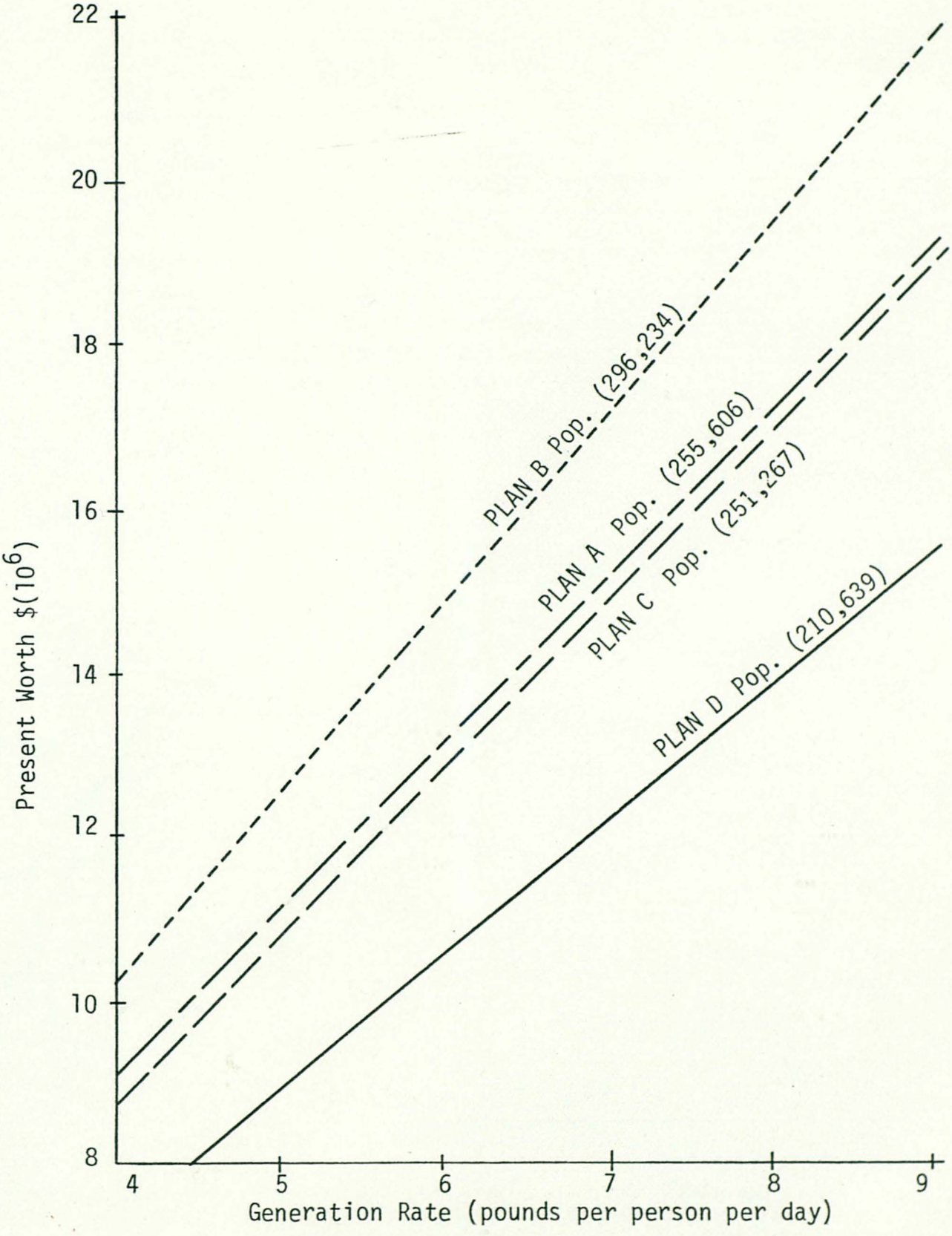

Fig. 19. Present Worth of System Design Based Upon Solid Waste Generation for Design Year Population.

APPENDIX A

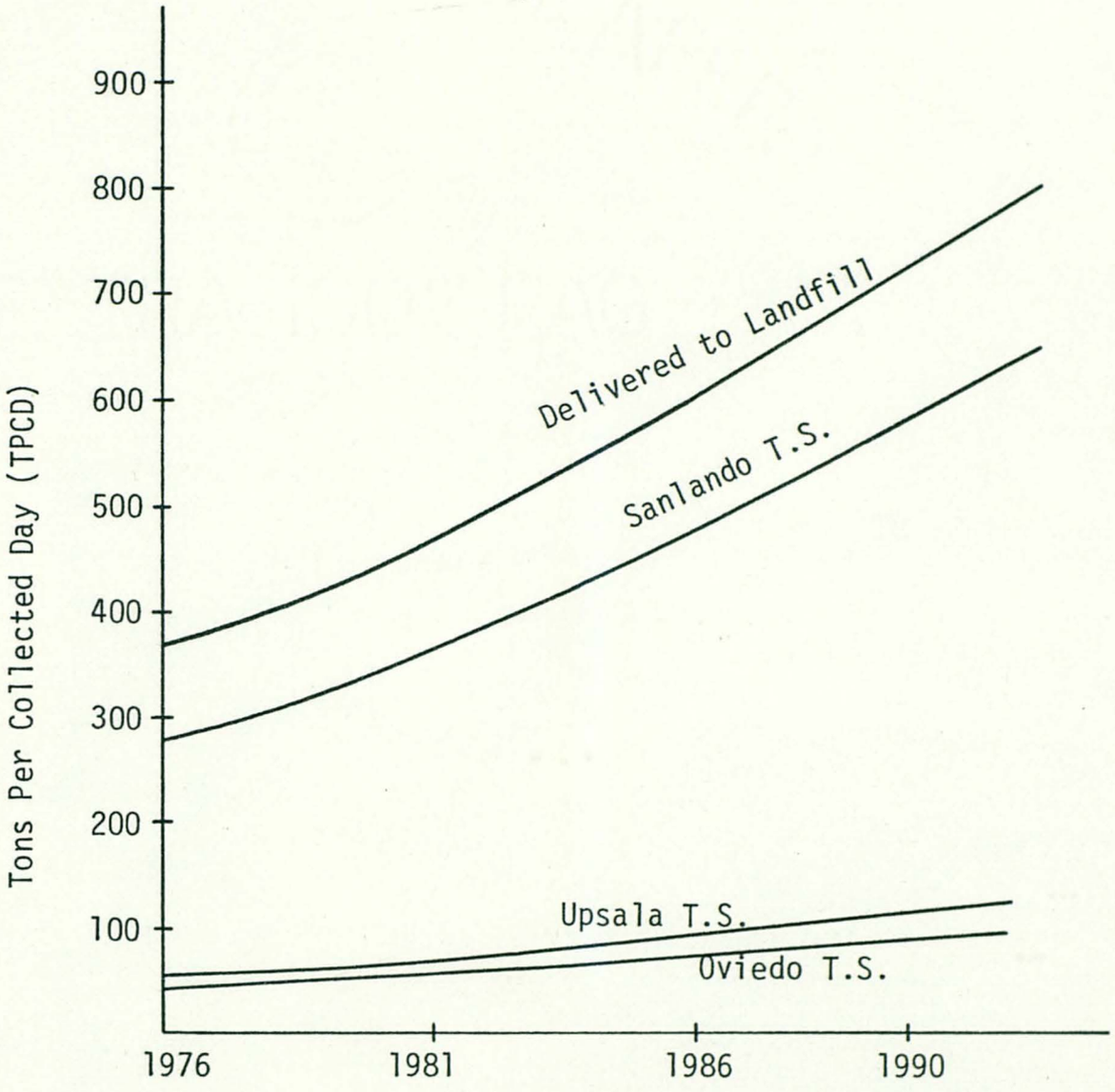

Fig. A-1. Seminole County Plan A Solid Waste Load at 4 Pounds Per Capita ...1976.

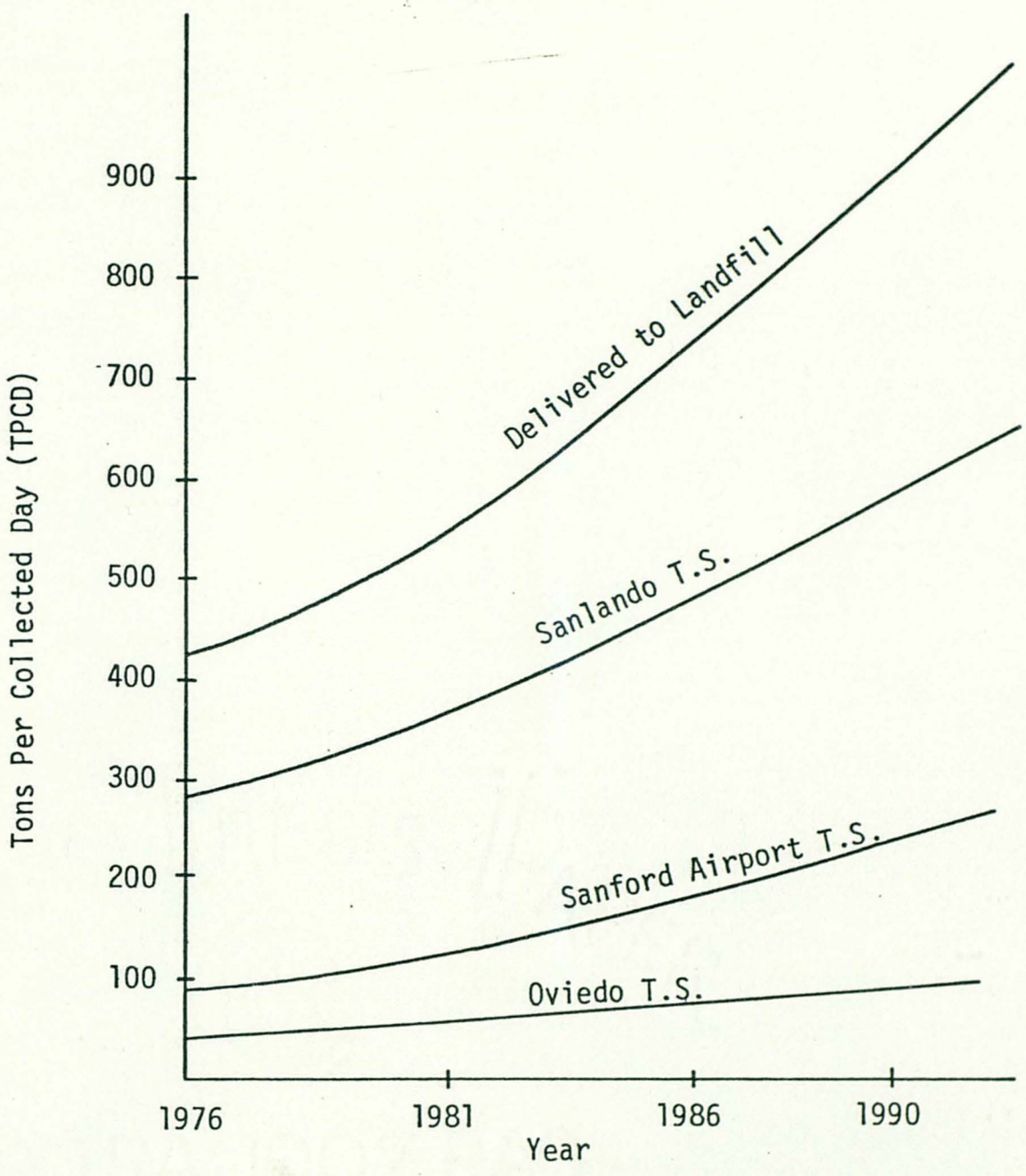

Fig. A-2. Seminole County Plan B Solid Waste Load at 4 Pounds Per Capita...1976.

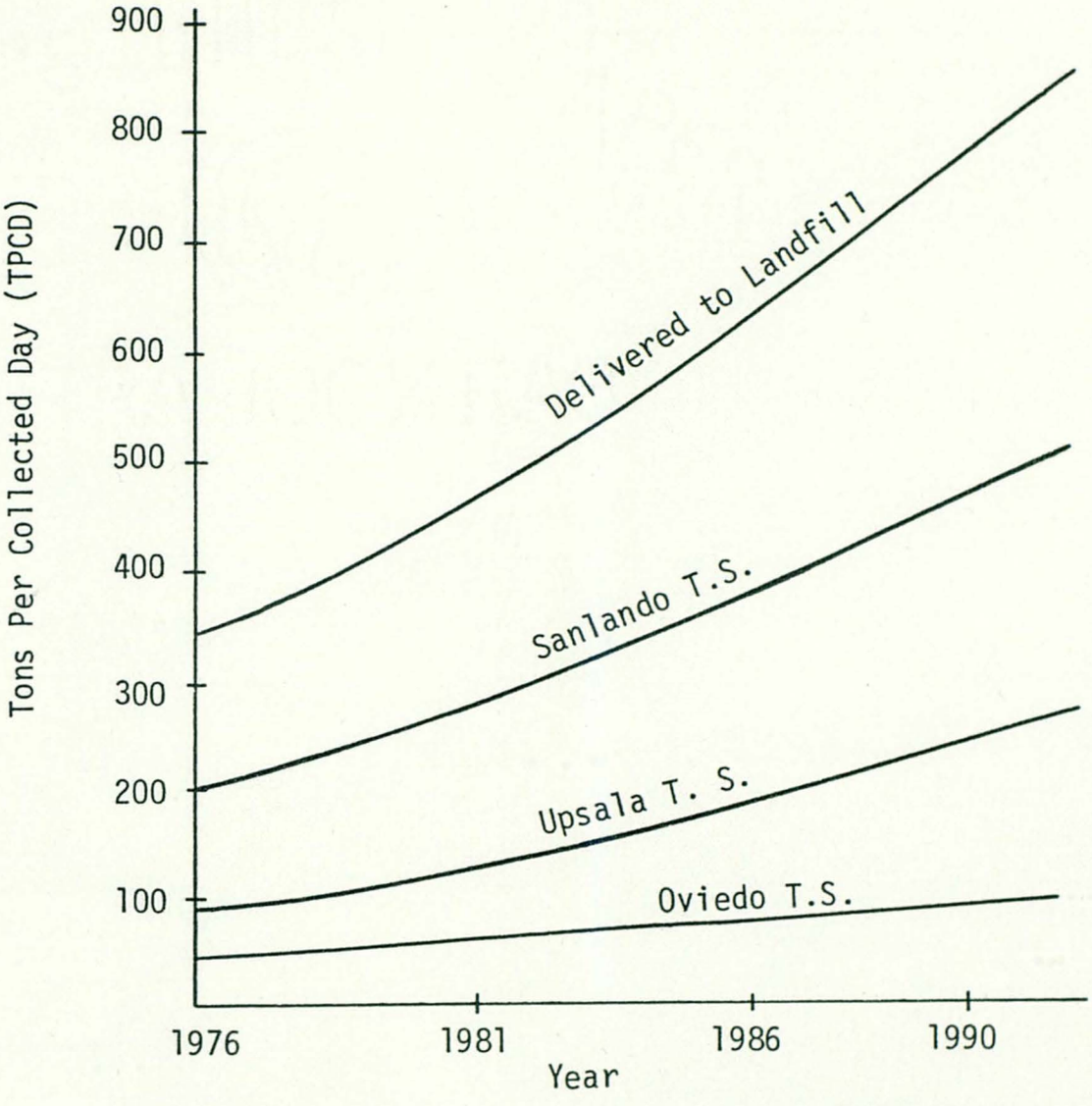

Fig. A-3. Seminole County Plan C
Solid Waste Load at 4 Pounds Per Capita...1976.

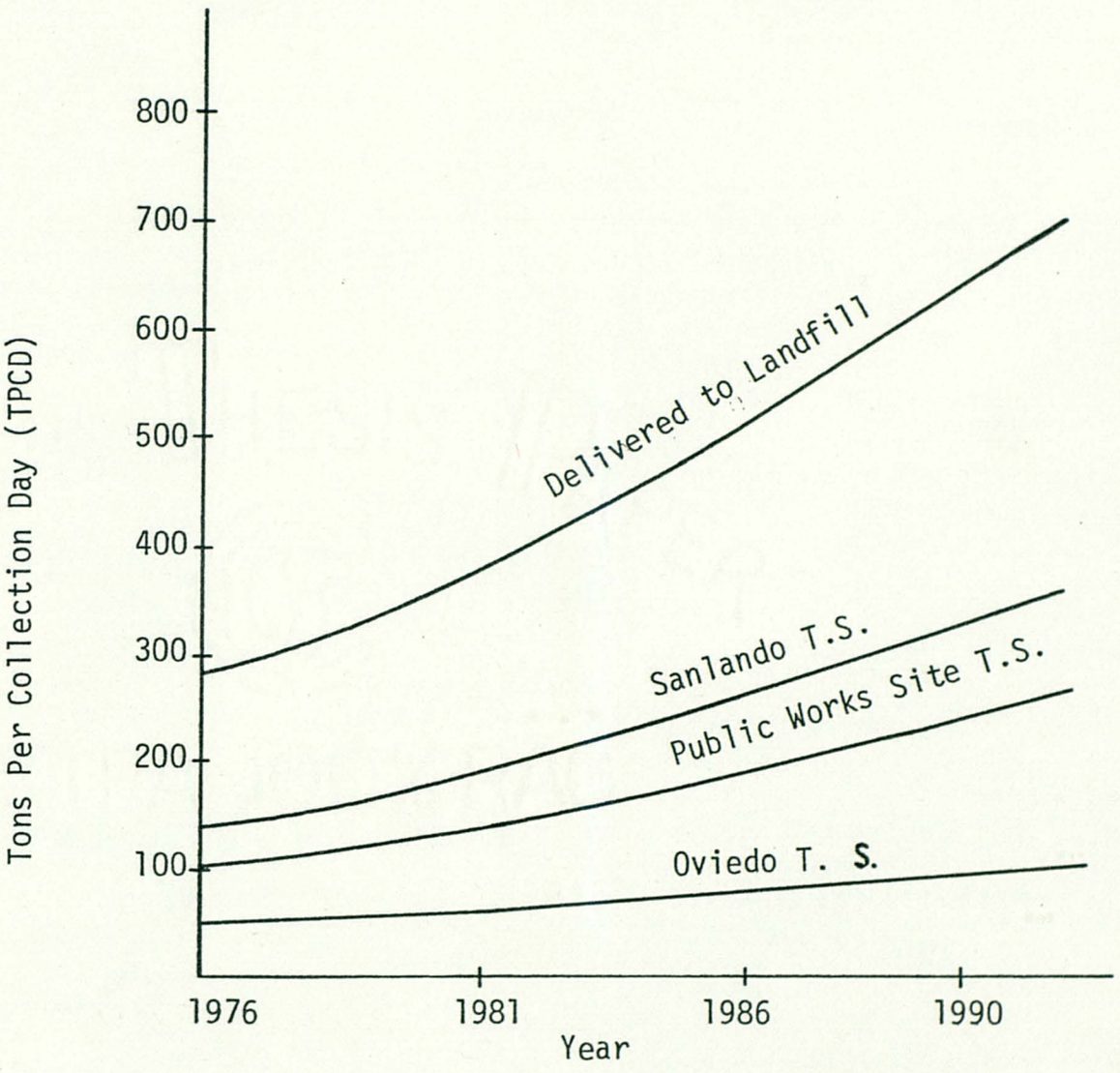

Fig. A-4. Seminole County Plan D
Solid Waste Load at 4 Pounds Per Capita...1976.

FOOTNOTES

[1]East Central Florida Regional Planning Council, "Planning Areas 1, 2, and 3 Population by Traffic Zones," Winter Park, Florida, 1976..

[2]Florida, Florida Statutes, Seminole County Comprehensive Planning Act, 1974, p. 2.

[3]U.S. Environmental Protection Agency, Heuristic Routing for Solid Waste Collection Vehicles, Solid Waste Series Publication No. SW-113 (Washington, D.C.: Government Printing Office, 1974), pp. 1-45.

[4]Orange County Solid Waste Management Phase 1 Report, ACT Systems, Inc. (Winter Park, Florida, February, 1976), p. 71.

[5]Seminole County, Florida, Solid Waste Management Report First Report of Solid Waste Management Team (Sanford, Florida, May, 1976), p. 9.

[6]Ibid., p. 12.

[7]Ibid., p. 9.

[8]East Central Florida Regional Planning Council, The Council Quarterly (Winter Park, Florida, Winter 1976), p. 8.

[9]Seminole County, Florida, Comprehensive Plan, An Analysis of Resources and Conservation Issues in Seminole County (Sanford, Florida, August, 1975), p. viii.

[10]Interview with William C. Kercher, Seminole County, Florida, Planner, Sanford, Florida, August 5, 1976.

[11]Seminole County, Solid Waste Management, p. 19.

[12]Paul A. Magnant, "An Investigation into Solid Waste Generation Rates for the East Central Florida Region," paper presented at Solid Waste Management Class, Florida Technological University, February 25, 1976. (Typewritten).

[13]Seminole County, Solid Waste Management, p. 14.

[14]Interview with Earl Melvine, Brevard County, Florida, Solid Waste Supervisor, Merritt Island, Florida, July 28, 1976.

[15]Fred Pregerio, "Estimating the Cost of a Transfer Station," Waste Age, July, 1974, pp. 6-9.

[16]Seminole County, Solid Waste Management, p. 23.

[17]Interview with Bill Petus, Seminole County, Florida, Solid Waste Supervisor, Seminole County, Florida, Public Works Yard, August 2, 1976.

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